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(54) Wireless data communication system

(57) Various problems arise in accessing the Internet. For example, Internet files have complex file addresses which are prone to incorrect entry by a user, giving rise to access of unwanted files. In one aspect the invention solves this problem by encoding the file address in a bar code symbol, decoding the bar code symbol and accessing the relevant file automatically.

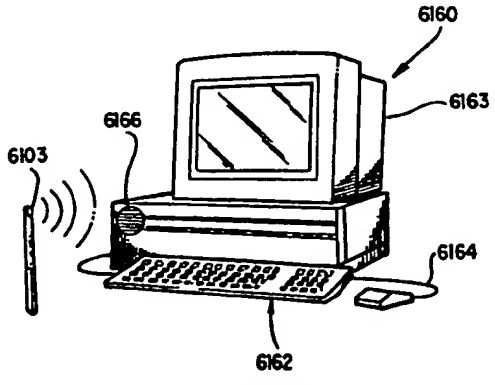

FIG. 27b

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reception and storage of messages in user mail boxes. The tasks generally operate independently, mail user agent being unaware of mail transfer agent status and simply having access to information about mail box details for each user. As discussed above, although the scheme is appropriate when mail boxes are permanently placed or mounted in a file system and accessible by all machines of a network, when a portable wireless hand-held system roams the local area and moves from one basic service area (file system) to another basic service area, the scheme does not operate reliably.

[0010] Typical examples of known mail delivery systems are discussed in, for example Sunexpert Magazine of April 1994 in an article entitled "Sendmail" by Peter Collinson. A message is input to mail user agent and dealt with by mail transfer agent. On large networks the various tasks are carried out by a mail hub machine to which all mail on a network is sent for processing. The system can be enhanced by introducing the possibility of expanding mailing lists, running mail through programs and automatic transfer of mail between certain users. A system becomes progressively more complex as it moves from local mail to mail on the Internet to mail between networks.

[0011] Further limitations are imposed because of the limited storage capability of hand-held computers (often known as personal digital assistants) as a result of which simple-store-and-forward, multi-user electronic message systems are generally impractical.

[0012] To operate on a wireless network, mobile units (MUs) must have a domain in order for them to associate with the access points (APs) in an access point group (APG). An APG is a group of one or more access points connected on the same router on the same network. All access points in the same APG are identified by the same domain. This allows the access points in one APG to communicate over the network without conflicting with other APGs on the same network.

[0013] The disadvantage of prior art domain assignment protocols is that some MUs may be used on multiple APGs, and possibly on multiple networks. Use of a mobile unit on multiple APGs would require changing the domain of the MU to allow it to communicate via the appropriate APG at the appropriate time. Use of a mobile unit on multiple networks might also require changing the domain, since the APGs on the new network might be in a different domain.

[0014] Further, when a TCP/IP stack is used (transmission control protocol/internet protocol), each network node must have a unique IP address for that network. The set of TCP/IP protocols typically encompasses media access, packet transport, session communications, file transfer, electronic mail, and terminal emulation. IP addresses for different networks need not be unique. If multiple networks are connected and nodes communicate across all networks, then the nodes require IP addresses that are unique across the expanded network.

[0015] In summary, each access point on a network must have a unique IP address for that network. Each mobile unit on a network, despite the domain it is using, must have a unique IP address for that network. Mobile units can be used on multiple networks. Use on multiple networks generally requires changing the IP address of the MU since the IP address currently in use by the MU might be in use by another MU on the new network or might not conform to the IP address conventions used by the new network.

[0016] Consequently, a system is required for assigning domains and IP addresses to mobile units to cover a variety of configurations and many different types of mobile units. Specifically, a system is required to allow for the assignment of domains and IP addresses to mobile units in ways that are sufficiently flexible to support installations where MUs are fixed to specific APGs on specific networks and where MUs travel among different APGs, and possibly among different networks, such as Spectrum One and Spectrum24 (Trademarks of Symbol Technologies Inc.) networks.

[0017] According to another aspect it has previously been proposed to implement a bar code scanner resident on a control machine running a COMPONENT OBJECT MODEL (COM) object. It is desired to increase the scope of such applications to be compatible with a wide range of models and in particular to introduce a bar code scanner remote from the machine and controlled through a wireless interface.

[0018] Pending European patent application 485,996 discloses, inter alia, a system for the replacement of depleted inventory using a system in which the replacement inventory items are labelled with bar coded ultimate-destination information, and packed into a container for shipment to a receiving/distribution centre.

[0019] It is known in general to make use of a two-dimensional bar code symbol, on the exterior of a container, to indicate what is inside: see Material Handling Engineering, October 1992, article entitled "New Dense Code Symbology Transports Data File".

[0020] The Internet computer network is gaining ever increasing significance in the world of science, technology, information and commerce amongst many others.

[0021] The Internet will be well known to the skilled reader but, in brief summary, comprises a network of computers practically worldwide and accessible from any access point suitably linked to retrieve information contained in the Internet. Various sub-networks exist within the Internet, one of the best known of which is the worldwide web.

[0022] Information is commonly stored on the Internet in the form of "pages" often comprising a "home page" relating to a general site and providing guidance and access to the contents at that site, the contents being contained in "sub-pages". A site includes a unique Internet Protocol address or Universe Resource Locator (URL). The site can thus be accessed from any access point to the Internet by entering the relevant address and displaying the site held at that

monly assigned herewith, a band-held optical reader terminal is provided having an ergonomic design. According to that system there is provided, inter alia, a hand-held optical reader arranged to fit in the hand of a user and including a reader component and a down-loading component. The device can include a display screen and a display screen for displaying control messages or video images, a keypad for inputting control or other data and a wireless communication link for down-loading data read by the reader component to an external device. The system can further include a plurality of interchangeable data collection modules connectable to the main body of the device, each module fulfilling a different function such as image/video capture, audio capture and so forth. As a result a simple multi-media module is provided.

[0033] It is desired, however, to arrive at a light weight hand-held data reader having a yet wider range of capabilities.

[0034] In view of the relative simplicity, availability and adaptability of information systems including bar code symbol data storage capability, it is desirable to develop systems particularly suitable for consumer applications. A wand-type optical reader which has many consumer applications is shown in Fig. 21. The arrangement, generally designated as 680 comprises a pen-shaped main body 681 having at its writing end an optical scanner element light emitter and detector 682 for reading a bar code symbol illustrated schematically as 683. The pen may also include actual writing capability, for example by having the writing nib adjacent the optical element 682 or, indeed, having the writing element and the optical element 682 at opposing ends. It is desired to increase the range of applications for such a product. The data processing capabilities of such a system 680 are limited by its physical size and power supply potential consequently limiting the range of applications of the arrangement. In addition various problems arise in actual operation of such a system, in particular in regulating the varying speeds at which consumers scan a given bar code symbol 683.

[0035] Conventional portable data terminals comprise a data display, data input means such as a keyboard and data storage and processing means. A wide range of applications are now available on such terminals including word-processing, spread-sheeting, data base applications and so forth. Much of the development work in known portable data terminals is centred on increasing the data storage and processing capabilities. This has led to increases in cost and size/weight (and the corresponding need to subsequently miniaturise components) together with increased complexity leading to increased potential for defect or breakdown.

[0036] In another aspect, US 5410326 relates to a programmable remote control device for interacting with a plurality of remotely controlled devices. The remote control device is configured to control a variety of devices and carries pictorial icons representing the different functions for selection by the user. The device is further configured to receive and display advertising messages, and operate various other functions such as electronic mail and order-out meal delivery. The system is, however, complex and cumbersome and of limited adaptability.

[0037] US 5,521,370 relates to a hand-held portable data capture terminal for example for warehousing, which is mountable in a terminal mount for data communication with a host computer and/or battery recharging. The specification is directed to a data interface between the terminal and the terminal mount comprising abutting electrical contact pads. The terminal is arranged only to communicate with the terminal mount when it is docked therein. The terminal carries a processor and memory system serving as a communication controller and can be arranged to act as network controllers when docked. A difficulty with such a system is that a considerable processing and memory capability is included in the hand-held terminal and that data is only downloaded when the terminal is docked in terminal mount.

[0038] US 5,280,621 relates to a control system for a personal computer. In conventional personal computers a system control processor provided an interface between the host processor and peripheral such as a keyboard. System performance was limited because of the slow communication rate between the system control processor and the keyboard, and was further degraded when the system control processor handled additional control burdens such as battery power management, external bus expansion control and so forth. According to US 5,280,621 it is proposed to introduce microcontrollers to provide communication between respective peripheral devices and the system control processor, freeing the system control processor to do other tasks improving the overall system performance.

[0039] The question of power management in portable devices has been addressed in various manners conventionally. US 5,027,294 relates to monitoring the voltage discharge of a battery power supply in which the user is issued warnings at various depletion levels allowing memory back-up, avoidance of over-depletion and so forth. US 5,504,413 recites a battery charging system including feedback input allowing minimisation of overhead voltage levels, and connection of a recharging device to a peripheral device via a port at the recharger. US 5,487,181 refers to power minimisation providing a main processor and a lower power processor which allows the main processor to "sleep" except when required. The lower power processor carries out various minor functions allowing the main processor to sleep as far as possible whilst being awoken as soon as required. US 5,511,205 relates power management in a portable pen-based notebook computer. The system has a plurality of independently controllable power planes selectively powerable to ensure that a particular task is performed with minimum power consumption. In addition separate CPU's operate synchronously in relation to one another reducing the amount of processing time the main CPU is required to dedicate to the power management function.

[0055] The client portion may display user options for selection by the user including the options of storing a message, retrieving a message, selecting the manner of display of the options and selecting the manner of playback. The options may be retrieved from the server portion by the client portion upon initialization of the client portion.

[0056] According to the invention there is provided a communication system for a bar code scanner comprising a control host, a scanning control object working therein and a remote client associated with the bar code scanner wherein the scanning control object communicates with the remote client to control the bar code scanner and the scanning control object is implemented as an OLE control. Accordingly there is provided a system capable of seamless communication between the scanning control and the remote client.

[0057] The host and the scanning object control may communicate and integrate via interfaces. The scanning control object may create separate threads of execution for controlling communication with the remote client. The separate threads of execution may include send, receive and synchronize bar code scanner transaction commands.

[0058] The scanning control object may be arranged to communicate with the remote client over an Internet or Intranet link and/or by wireless communication.

[0059] According to the invention there is further provided:

1. A method of reading a high density bar code symbol containing information comprising data and data interpreting information, comprising the steps of receiving a signal representative of the information contained in the bar code symbol, identifying the data and the data interpreting information, processing the data interpreting information and interpreting the data according to the processed interpreting information.
2. A method as in 1 in which the data interpreting information comprises a program script, wherein the method comprises the steps of processing the programmed script to create an interface for interpreting the data.
3. An information retrieval system comprising a high density bar code symbol and a bar code symbol reader, wherein the bar code symbol contains information comprising data and data interpreting information and the reader includes means for reading the bar code symbol, means for identifying the data interpreting information, means for processing the data interpreting information and means for interpreting the data according to the processed interpreting information.
4. A communication system for a bar code scanner comprising a control host, a scanning control object working therein and a remote client associated with the bar code scanner wherein the scanning control object communicates with the remote client to control the bar code scanner and the scanning object control is implemented as an OLE control.
5. A system as in 4 in which the host and the scanning object control communicate and integrate via interfaces.
6. A system as in 4 in which the scanning control object creates separate threads of execution for controlling communication with the remote client.
7. A system as in 6 in which the separate threads of execution include send, receive and synchronize bar code scanner transaction commands.
8. A system as in claim 4 in which the scanning control object is arranged to communicate with the remote client over an Internet or Intranet link and/or by wireless communication.

According to the present invention there is provided a data terminal connectable to, and remote from, the Internet comprising a data input and an internal server for creating an Internet site representing the input data and having an Internet Protocol address, the terminal further comprising a network link cooperating with the server to provide access to the site to users elsewhere on the Internet. The system thus provides substantial benefits as regards speed, efficiency and accessibility.

The Internet site may be a web site. The data input may comprise one or more of the group of image recordal means, sound recording means, or text recordal means. The network link may be a wireless network link comprising one of the group of a radio frequency link, an infrared IRDA standard link or a microwave link over a private wireless local area network, or a cellular telephone network.

According to the present invention there is provided a data terminal connectable to, and remote from, a data network comprising a data input, means for creating a user accessible data site representing the input data and having a site address and a network link arranged to receive access requests from users elsewhere on the network addressed to the site, and provide access to the addressed site.

The network may comprise one of the group of the Internet, an Intranet or a Local Area Network (LAN), for example the network comprising the Internet and the site address comprising an Internet Protocol address. The site may comprise a Web site.

The data input may comprise one of the group of image recordal means, sound recordal means or text recordal means, or even a chemical "sniffer" which detects the presence of certain chemicals in the air (e.g. natural gas, or other combustible or hazardous fumes). The data site creation and access means may comprise a server internal to the terminal. The network link may be a wireless link comprising one of the group of a radio frequency link, an infrared IRDA standard link or a microwave link.

According to the invention there is further provided a still image capture device comprising a digital camera, an encoder for encoding the still image as an image data signal, and a transmitter for transmitting the image data signal by wireless transmission to a remote base station.

According to the invention there is further provided a method of capturing and relaying an image comprising the steps of capturing the image using a remote image capture device, encoding the captured image as an image data signal and transmitting the image data signal, the encoder and transmitter being provided in the remote image capture device, and receiving the transmitted image data signal in a base station for distributing the image. The image captured may relate to a given incident and the base station may transfer the received image to an insurance database relating to the incident.

The image captured may relate to the condition of goods prior to delivery and the received image may be transferred from the base station to a delivery point for comparison with the received goods.

The image captured may relate to the condition of goods to be delivered, the image data signal may be encoded as a bar code symbol applied to the goods to be delivered, and the bar code symbol may be decoded at the point of delivery for comparison of the captured image with the condition of the goods as received.

According to the invention there is provided a product information retrieval system for use in conjunction with the Internet computer network, wherein product information relating to a selected product is accessible at an Internet site having an Internet Protocol site address, wherein the site address is directly or indirectly represented by a machine-readable printed indicia, and wherein a hand-held reader is provided for reading the indicia, storing the site address represented thereby and down-loading the site address to a client processor for accessing the product information at the site address. The product may comprise a commercial product. The commercial product may be displayed on printed matter, the machine-readable indicia being printed in association therewith. Alternatively the commercial product may be displayed at a retail outlet and the machine readable indicia may be printed on the product or product packaging.

The machine-readable printed indicia may comprise a bar code symbol. The hand-held reader may comprise a bar code reader, for example a field of view optical reader, such as a "wand" type optical reader.

The bar code symbol may be printed in one of the group of formats comprising: UPC, EAN.

The data in the bar code symbol may represent the a site address, or may simply be a product code which can be utilized to look up a corresponding site address in a table, and the site address may be converted into a URL at the client processor.

According to the invention there is further provided a "wand" type hand-held optical reader comprising reading means for reading a printed indicia and data storage means for storing the data represented by the printed indicia, arranged to read the printed indicia associated with a selected product, the reader further having a down-loading port for down-loading the stored data to a client processor to retrieve additional data relating to the product.

In its preferred form the invention further includes:

28. A reader comprising a bar code reader.
29. A reader in which the reader downloads the stored data to an access point to the client processor.
30. A reader in which the data represented by the printed indicia relates to a selected product and the retrieved data comprises additional information concerning the product.
31. A reader in which the access point comprises an interface to a personal computer.
32. A reader as in 31 in which the access point comprises a dedicated down-loading port.
33. A reader in which the stored data is transferred via a touch memory interface.
34. A reader in which the identification information is transferred via an optical interface via an IRDA standard link.
35. A reader in which the reader storage means stores data relating to the reader user, and the reader user information is transferred together with the stored data to the client processor.
36. A reader in which the printed indicia accompanies a representation of a commercial product.

The client processor may be linked to the Internet computer network and the printed indicia may contain an Internet Protocol site address corresponding to an site containing additional information relating to the product. Accordingly the system requires no more than standard address protocols. The reader may comprise a bar code reader.

According to the invention there is further provided a method of retrieving product information wherein the product information is stored at an Internet computer network site having an Internet Protocol site address, and the site address is represented in the form of a machine-readable printed indicia, comprising the steps of reading the printed indicia using a hand-held reader, storing the site address data represented by the indicia in the storage means in the hand-held reader, down-loading the site address data from the hand-held reader to a client processor linked to the Internet and accessing the Internet site identified by the site address.

The product may be a commercial product. The printed indicia may accompany a representation of the product in printed matter or the product may be displayed at a retail outlet, the indicia being printed on the product or its packaging.

received from the terminal and the terminal includes a user interface, a mount interface and processor capability sufficient only to relay user input to the mount for processing and data from the mount to the user interface. Thus an ultra thin client is provided at the terminal, the mount carrying out the majority of the computing functions.

In another aspect the invention relates to a data processing system comprising a stand-alone data terminal, docking means for docking the terminal and a host network, the terminal including a user input and docking means interface arranged to relay user input to the mount and the mount including a terminal interface and a host interface arranged to relay the user input to the host, for processing and a method of relaying data between a portable terminal and a base station comprising the steps of inputting data to the terminal, relaying the data to the base station with minimal processing and processing the data at the base station. Optionally, therefore, the majority of the processing power can be maintained at the host, allowing a thin docking means or cradle.

Preferred features further comprise:

37. A method in which the terminal and base station communicate via wireless communication.
38. A method in which the information input to the terminal comprises inventorying information.
39. A method in which the information input to the terminal comprises retail related information.
40. A method in which the information input to the terminal comprises stock exchange related information.
41. A method further including the step of physically connecting the terminal to the base station at intervals for data downloading and/or battery recharging.

According to another aspect the invention provides a product information retrieval system comprising a portable terminal arranged to receive data from one or more data output points in a product access zone in which the terminal is arranged to display an image of a product to be accessed in response to data received from the data output point and a method of retrieving product information in which a portable terminal is provided in a product access zone and receives data from one or more data output points, and in which the terminal displays an image of a product to be accessed in response to data received from a data output point, and a portable data terminal for operation in an operation zone having one or more physical items located at predetermined positions in the zone wherein the data terminal comprises a communications receiver and/or transmitter and a display arranged to display icon's representative of the physical item and/or its position in the operation zone. This icon based system allows a highly user-friendly, efficient and human-error free file system to be implemented.

Yet further preferred features comprise:

42. A system in which the terminal receives data from the data output point by wireless communication.
43. A system in which the product image corresponds to a product in a vicinity of the terminal.
44. A system in which a plurality of data output points are provided and the product image is selected from products in the vicinity of the data output point from which the terminal is receiving data.
45. A system in which the terminal includes a positioning system and the product image corresponds to a product in the vicinity of the detected position of the terminal.
46. A system in which the terminal is arranged to display a map of the product access zone.
47. A system in which the terminal is further arranged to indicate the position of the terminal on the map.
48. A system in which the product access zone comprises a retail outlet.
49. A system in which the terminal is arranged to display an image of a product on offer.
50. A system in which a terminal user inputs identification information to the system.
51. A system in which the terminal is arranged to display an image of a product related to user preference derived from the user identification information.
52. A system in which the terminal further comprises one or more of the group of an optical reader or a data pen.
53. A system in which the terminal further includes an audio speaker.
54. A system in which the terminal further includes a voice synthesizer for relaying product or other information.
55. A system In which the terminal includes a range alarm arranged to activate if the terminal leaves the product access zone or a zone defined related to the product access zone.
56. A product information retrieval system further comprising a terminal docking point arranged to receive the terminal for battery charging and/or data relay.
57. A system in which the terminal is arranged to display an image of a product to be relocated together with relocation information.
58. A system in which the product access zone comprises a storage zone and a terminal is arranged to display an image of a product to be relocated together with relocation information.
59. A method of retrieving product information in which a portable terminal is provided in a product access zone and receives data from one or more data output points, and in which the terminal displays an image of a product to be accessed in response to data received from a data output point.
60. A portable data terminal for operation in an operation zone having one or more physical items located at predetermined positions in the zone wherein the data terminal comprises a communications receiver and a display arranged to display icon's representative of the physical item and/or its position in the operation zone.

76. A network in which a routing table is developed at the communication network for goods to be tracked.

77. A network in which each interface comprises a base station and a portable data terminal in mutual wireless communication.

78. A rechargeable battery pack in which a recharging requirement comprises the charging rate.

79. A battery recharger comprising a plurality of battery pack receiving and recharging points.

The invention further provides a data device arranged to communicate with a communication network including an adapter module interface and an adapter module in which the adapter module carries network communication capability and an adapter module for a data device communicating with a communication network in which the adapter module carries network communication capability for the device. As a result transparent network file access is achieved.

Further preferred features include:

80. A device in which the adapter module comprises an adapter card.

81. A device in which the network communication capability includes at least one protocol stack and at least one network file system client.

82. A device in which the protocol stack and network file system client run on a processor in the adapter module.

83. A portable data communication device comprising data capture means, an adapter module interface and an adapter module, wherein the adapter module includes an internal server for creating an internet site and communication means for communicating with an access point to the Internet.

84. A terminal in which the adapter module comprises an adapter card.

85. An adapter card for a portable communication device, the adapter card comprising a device interface, an internal server for creating a network file for data captured by the device and a network interface.

86. A power pack for cooperation with a device to power the device, the power pack comprising rechargeable cells, charging circuitry and a connector for connecting to a power supply to recharge the cells.

87. A power pack in which the charging circuitry comprises one or more of the group of: AC/DC conventor, charge electronics, gas gage.

88. A power pack in which the rechargeable cells are replaceable.

89. An adapter for a battery charging system including a battery pack and a recharger in which the adapter includes a battery pack interface, a recharger interface and charging control circuitry.

90. An adapter further including a power input for direct recharging.

91. An adapter further including one or more indicators for indicating charging status.

92. A rechargeable power pack for a device, the power pack being rechargeable by a recharger unit and including charging circuitry and power cells in which the power cells are replaceable.

BRIEF DESCRIPTION OF THE DRAWINGS

[0060] The foregoing objects and advantages of the present invention may be more readily understood by one skilled in the art with reference being had to the following detailed description of several preferred embodiments thereof, taken in conjunction with the accompanying drawings wherein like elements are designated by identical reference numerals throughout several views, and in which:

Fig. 1 is a perspective view of an optical reader from above and the rear;
Fig. 2a shows a terminal according to the present invention arranged to link with the Internet;
Fig. 2b shows a block diagram of the connection system shown at Fig. 2a;
Fig. 2c shows an alternative configuration according to the present invention;
Fig. 2d is a flow diagram representing operation of the present invention;
Fig. 3a is a perspective view of a data terminal according to the present invention;
Fig. 3b shows an implementation of the data terminal according to the present invention;
Fig. 4 is a block diagram showing components of the data terminal of Fig. 3a;
Fig. 5 shows a hand-held data terminal;
Fig. 6 is a detail of a data terminal according to the present invention having highlighting capabilities;
Fig. 7 shows a data terminal according to another aspect of the invention;
Fig. 8 shows an alternative configuration for the terminal of Fig. 5;
Fig. 9 shows a portable computer device according to another aspect of the invention;
Fig. 10 is a block diagram of an image capture module for the device of Fig. 9;
Fig. 11 is a block diagram of a multi-media module for the device of Fig. 9;
Fig. 12 is a perspective view of a variation of the device of Fig. 9;
Fig. 13 is a block diagram showing the components of a distributed mail delivery service according to another aspect of the invention;

Fig. 49 is a block diagram of yet a further alternative cradle configuration;
Fig. 50 shows software data and control flow in the terminal;
Fig. 51 shows software data and control flow in a cradle;
Fig. 52 is a block diagram showing components of an embedded storage device;
Fig. 53 is a block diagram showing a configuration of an alternative storage device;
Fig. 54 is a block diagram showing the configuration of yet a further alternative storage device;
Fig. 55 is a block diagram showing operation of a standard Client Device and File Access Card;
Fig. 56 is a block hardware diagram of an alternative Client Device and File Access Card system;
Fig. 57 is a software block diagram of the alternative File Access Card system;
Fig. 58 shows a hardware model for a web-enabled terminal;
Fig. 59 shows a task structure for the arrangement of Fig. 58;
Fig. 60a shows a transparent web server;
Fig. 60b shows a transparent web server card;
Fig. 61a shows browsing in relation to the transparent web server;
Fig. 61b shows another aspect of browsing in relation to the transparent web server;
Fig. 62 shows an alternative inventive battery pack;
Fig. 63a shows an improved battery pack arrangement; and
Fig. 63b shows an alternative improved battery pack to that shown in Fig. 63a, in cut-away form.

Detailed Description of the Preferred Embodiments

[0061] Throughout the description of the optical reader the terms "front", "rear", "upper", "above", "lower" and "below" are used consistently. Referring, for example, to Fig. 1 an optical reader has a rear end 4 and a generally planar front end 5, an upper face 2a and opposed to that a lower face 2b.

[0062] Referring to Fig. 1 in more detail the optical reader includes a generally bar-shaped elongate housing indicated generally by the reference numeral 1, having two generally opposed long broad upper and lower faces 2a, 2b, two generally opposed long, shallow side faces 3, a rear end 4 and a front end 5.

[0063] A reading arrangement is mounted within the housing. The reading arrangement may be any known conventional arrangement, for example a "flying spot" optical scanner or a "field of view" optical reader. Generally the arrangement will include a light generating source such as a laser diode, a beam focusing or directing arrangement and a light receiving device. Where the reading arrangement is an optical scanner a rapidly oscillatable scan component, such as a mirror is provided to scan the light beam across an indicia to be read. Alternatively, the laser diode itself can be oscillated. Where the reader is a field of view optical reader a charge coupled device (CCD) array, or a photodetector arrangement is provided to detect the reflected light beam.

[0064] In order to actuate the reading arrangement a scan trigger 9 is provided on the upper surface 2a of the housing 1. The trigger 9 is activated by depression and is positioned along the housing 1 such that it is easily actuable by the operator when the reader is held in the operator's hand. The trigger mechanism itself may be of any known arrangement; for example the trigger may be spring-loaded and have contacts which form a circuit with contacts within the housing when the trigger is depressed to actuate the reading arrangement.

[0065] A scanning window 10 is positioned on the front face 5 of the reader. Light generated by the reading arrangement passes through the window 10 and is reflected and scattered back through the window 10 by a bar code symbol 11. Accordingly the reader can be easily and accurately aimed at a bar code symbol 11 to be read.

[0066] Also provided on the upper face of the reader are a keypad 14 and a display 15. The keypad 14 may be used to initialize the reading arrangement such that identification information concerning the user is entered into the system. Alternatively, the keypad 14 may be used to enter predetermined codes or information concerning modes of operation of the reader or to carry out cancellation or manipulation operations on information provided by the reader. The display 15 may display information relating to the mode of operation of the reader, or display check information relating to the item carrying the bar code symbol being read together with background information such as the time, date, and confirmation of the operator's identity. Preferably the display 15 is a liquid crystal display (LCD).

[0067] The reading arrangement can process information derived from the bar code symbols directly or can send raw data to an external processing device which can then process the information accordingly. In addition, information derived by the reader from bar code symbols can be transferred to a memory device in order that a database of information can be built up. For example where the reader is used at a point of sale, buying patterns can be stored and analyzed. Alternatively, if the reader is being used for inventorying purposes then the inventory information can be stored. The optical reader can transmit information in a variety of manners. In the embodiments shown various different transmitting devices are provided; in practice only one or more of the devices need be provided depending on the particular use to which the reader is to be put. For example the information may be transmitted by an acoustic modem 16. In that case, information can be stored in a buffer memory within the reader and then down-loaded by the acoustic modem 16

modules. As a result their interchangeability is enhanced.

[0079] A suitable architecture for an optical media capture module 28 (for example containing a CCD imager or laser scanner) is shown in Fig. 10. Each module may contain only the media capture electronics without any pre-processing capability or, as discussed above, preferably contains dedicated or programmable analog components 32 and digital signal processing (DSP) components 33 to ease the processing load placed on the central processing unit of the main body 21. The digital signal processing sub-system 32,33 in the module may be of a single electronic design common to different modules, and which is either programmed in the factory or customized on purchase or programmable by the user to perform the functions in processors if required by the particular media module. This function programmability is expected to be mainly through software, since the module processing electronics are flexible, and these software components may be one-time or dynamically loaded to the module via the main body central processing unit Accordingly the range of components that require manufacture is decreased, appropriate dedicated parts of the components being selectable for a desired use, or a portion of the mode of operation being borne by software.

[0080] In operation, the module 28 collects information via the CCD imager or laser scanner in analog form which is transferred either serially or by conversion into a parallel format. The analog signal is then processed by the digital signal processing sub-system 32,33 and forwarded to an interface bus 34 from which the information is transferred to the main body of the portable computing device. As mentioned above, the signal processing electronics preferably perform up-front data processing such that a common bus architecture to the portable computing device 21 can be achieved.

[0081] Referring now to Fig. 11 the multi-media module 22 includes circuitry for image/video capture, audio capture and playback and a cellular telephony sub-system.

[0082] The module is arranged to receive and transmit video information independently of the main body of the portable computing device (although the video information may also be accessed by the main body of the portable computing device in order to monitor or review the information). Accordingly a radio frequency antenna 41 is provided in the module for reception and transmission of radio frequency information. A radio frequency front end processor 42 and codec 43 cooperate to perform digital to radio frequency/radio frequency to digital format conversions. Video information received via radio frequency is decompressed by an optional digital signal processing sub-system 44 for presentation, where appropriate, to the CPU of the main body 21 of the portable computing device. A further digital signal processing sub-system 45 is provided for other purposes (discussed in more detail below) and preferably performs partial video processing, the CPU of the personal computing device completing the process for displaying the results. The second digital signal processing sub-system 44 may also be required for the interface to the radio frequency codec 43 of the cellular sub-system; this depends on the amount of processing required for each function. Video information transferred to the main body 21 of the portable computing device is displayed on the LCD display 23. The radio frequency receiving, transmitting and processing apparatus 41,42,43,44 discussed above can optionally reside in a separate component such as a PCMCIA or other type plug-in card for example of the type manufactured by Symbol Technologies, Inc. Preferably, however, the circuit forms an integral part of the multi-media module to provide a full wireless multi-media solution for the hand-held computing system. As will be appreciated, the wireless link may conform to any desired cellular standard (for example CDMA, GSM, AMPS) that is preferably selected to allow the widest application of the invention.

[0083] The multi-media module 22 further includes a microphone/speaker component 50 which receives and transfers input analog information to an analog to digital converter 51,45 comprising an up-front voice-band converter 51 which transfers information either serially or in parallel to the digital signal processing sub-system 45. Similarly, information may be transmitted in the other direction, for example digital information from the main body of the portable computer device is converted to an analog audio signal at converter 45,51 and converted to sound by the speaker component 50. Base-band digital audio data is processed by the digital signal processing sub-system 45 which can be reprogrammed as appropriate to perform appropriate audio codec processing. Voice-band (VB) signals are converted by the converter 45,51 as discussed above.

[0084] Video data is captured by a CCD imager 52 compressed by a digital signal processing sub-system 53 and forwarded to the radio frequency codec 43. Once again the main body of the portable computing device need not be involved in this data transfer unless the user decides to monitor the transfer. In that case, a software controlled process may be initiated whereby the video data is sent to the CPU of the main body 21 of the portable computing device for display before compression as well as to the radio frequency codec 43 for transmission allowing the captured image to be viewed while or before transmitting.

[0085] The multi-media module 22 is preferably mounted so as to be rotatable through at least 180° when connected with the main body of the portable computing device. This may be achieved by hinging or pivoting or otherwise arranging a portion of the main body or by similarly arranging a portion of the module. This positioning allows capture of the user's image while the user can simultaneously view the LCD screen display for received video data or images. The rotation of the image capture portion of the module permits capture of images of objects in front of the user while the user is looking at the screen.

hardware performance. The message coder and decoder 111 interacts with the mail user agent 112 providing user interface. In addition the mail user agent 112 communicates with a local data storage device 113 and with optional modules such as a display driver 114 and/or a sound driver 115 (see client 101a).

[0095] Operation of the distributed mail delivery system may best be understood with reference to Figs. 14 and 15. Fig. 14 displays the steps carried out by the user in a typical "client process". On commencement of operation the client auto-configures itself based on the resources (for example sound or graphics) available on the machine [step 120]. The user logs in and enters a password [121] and a connection is established between the client and the server [122] at which stage information entered during the log-in and password process is sent to the server for verification [123]. If, however, the server is not ready for communication then the procedure is exited [124] and must be recommenced at step 120 or step 121. After the user status is queried [123], if the user or password is unknown to the server the process returns to step [121] and the log-in and password procedure is re-initiated. Otherwise the options available to the user are retrieved [125] in steps discussed in more detail with reference to Fig. 15 and displayed as headers to the user [126]. The user then enters his selection [127] and the selection type is determined [128].

[0096] The client assesses whether the user wishes to view a message [129] and if so retrieves the selected message from the server [130] in a series of steps described in more detail below with reference to Fig. 15. The client then determines the message type, for example audio or visual [131] and dependent on the message type either displays the text [132] or plays the sound [133]. The client then returns to step [127] and awaits a further user selection.

[0097] If at step [129] the user indicates that it is not desired to view a message then a message is created [134], recorded [135], the data of the message is packaged appropriately for transport [136], for example by the protocol stack 111 shown in Fig. 13, and is sent to the server [137] by the transmitter 110 and antenna 109. The client then returns to step [127] and awaits a further user selection.

[0098] The client machine includes suitable input means, for example a keypad and display means for example an LCD display for the entry of user selection choices, message information and for the display of messages. In addition a speaker and microphone may be provided for the recordal and playback of audio messages. A portable computer device such as that shown in Fig. 9 may, for example, be used as the client 101. In that case, auto-configuration of the client is carried out partially in dependence on the type of module 22 inserted into the main body 21 of the portable computer device 20.

[0099] Referring now to Fig. 15 the steps of a typical "server process" are shown. The server operates as a continuous process but, in order to save system resources is mostly in a stand-by mode where it simply listens to the local network. Accordingly in step [140], on initiation, an open end connection is established and the server monitors the connection [141]. If any queries are received [142] the server proceeds to the subsequent steps but otherwise continues to monitor the connection [141]. On reception of a query the server "wakes-up", interprets the query to establish which of the internal modules of the server is designated [143] (for example data base storage 106 or mail user agent 107) and if the request is valid [144] the request type is determined [145]. The request may be a HEADER which is sent to the client to present user message headers (corresponding to steps [125] and [126] shown in Fig. 14); accordingly at the request for a header [146] appropriate information is retrieved [147], is packaged for transport [148] for example at modules 104,103 of the server and is sent to the client [149]. The server then returns to monitoring mode [141] listening to the connection with the remainder of the network.

[0100] If at step [146] the request is not for HEADER information then the server retrieves any user messages [147] that are stored in respect of the identified user (for example on the basis of the log-in or password information entered at the client) and the data is packaged and sent as described above in relation to steps [148,149]. The system then returns to monitoring mode [141].

[0101] It will be seen that steps [142-147] are carried out by the query engine 105 of the server, user message data being retrieved from the memory device 106 of the server.

[0102] Where, at step [144] the request is not valid then the user and request are logged and an error message is sent back to the client [151]. The system then returns to monitoring mode [141].

[0103] The system described above requires far less data storage on the client terminal/computer and thus is particularly (although not exclusively) suitable for hand-held computers with basic network capabilities. The system thus resolves the problem of mail box locations as well as releasing the hand-held host and the data storage and retrieval responsibility by treating the mail delivery service as two cooperative and independent processors that communicate with each other using basic network protocols.

[0104] In effect, unlike conventional mail delivery service systems, the distributed mail delivery service uses the underlying network to actively present enquiries to the server regarding the message status relating to a particular user, rather than using a directory structure and relying on a file system. Because all enquiries are directed to one server, multiple connections for a single user can be identified and refused, the server is the only point of connection to external entities, offering a more secure delivery system and the server offers a view of the mail delivery service to the end user which is independent of the actual matter stored by the server. In addition clients are relieved of the responsibility of storing or directly retrieving any of the actual data. Messages are delivered via the network on a demand basis, that is

21; and perform other maintenance tasks.

[0117] Fig. 17 illustrates a typical conventional flow chart of the actions taken by the access point 170 when it receives a packet of data from he mobile unit 21 on the wireless network. If the packet is a registration packet, determined at step 200, then the access point 170 processes the information carried by the packet at step 214. The type of association is determined by examining the IP address of the mobile unit's 21 home access point and does the control message exchanges accordingly at steps 216 and 226. If the packet is not a registration packet, as determined by step 200, then the packet is decapsulated at step 202.

[0118] If the short term address mapping tables (ST-AMT) of the access point 170 has an entry for the packet's source MAC address, determined at step 204, then the packet has originated from the mobile unit 21 that is away from its home stationary data link (SDL) network and processing passes to step 218. At step 218 the access point 170 encapsulates the packet within a UDP packet with the IP destination address set to that of the mobile unit's 21 home access point.

[0119] If the long term address mapping tables (LT-AMT) of the access point 170 has an entry for the packet's destination MAC address, determined at step 206 then the packet is meant for a mobile unit that is currently outside its home access point group (APG) and processing proceeds to step 220. At step 220 the access point 170 encapsulates the packet within an UDP packet with the IP destination address set to the destination mobile unit's local access point.

[0120] If the packet's destination MAC address is a broadcast address, determined at step 208, then the packet if forwarded at step 222 on its wired and wireless interfaces. If the destination MAC address in the packet appears in the access point's mobile host table (MHT), determined at step 210, then the packet is encapsulated within a wireless link layer packet and forwarded on the wireless interface at step 224. Otherwise, the packet is forwarded on its wired interface at step 212.

Part 2: Assigning domains and IP addresses to said pen-based mobile units 21.

[0121] The following embodiments of the present invention deal with assigning domains and IP addresses to the mobile units 21 to operate in a wireless LAN technology, such as the previously discussed Spectrum One and Spectrum24 systems.

[0122] According to an embodiment of the present invention the domains and IP addresses are hard coded. The hard coded embodiment involves setting the domain and IP address of the mobile unit 21 in the configuration files associated with the Spectrum24 drivers and protocol stacks.

[0123] The hard coded embodiment provides a relatively simple implementation of domain and IP address assignment for Spectrum24 network installations when only a few mobile units 21 are used that always use the same APG on the same network. In addition, a high degree of security is provided since the ability to detect and assign domain and IP addresses are available only in the configuration area, not in the operational area.

[0124] The hard coded configuration of each mobile unit 21 ensures that the domain and IP address information are non-volatile. This insures that even cold booting the mobile unit 21 will not require reconfiguration. All the access points 170 in the target APG can be configured to use the hard coded domain. The server can be set up to reserve permanently (without any timeout) the hard coded IP addresses for use by each hard coded mobile unit 21.

[0125] Another embodiment of the present invention involves the application-selection of domains and IP addresses. This embodiment is suitable for situations where a system administrator manually configures the mobile units 21 before their use by operators by setting the domain and IP address. In particular, when mobile units 21 are the only nodes on the network or when the system administrator set domains and IP addresses by referring to a master list maintained on a network server the application-selection system is advantageous.

[0126] For situations where the operator must identify the selections as he moves between APGs or networks a more sophisticated application is provided to allow the system administrator to establish logical names for domains and IP addresses so that operators can pick the appropriate settings by choosing a meaningful name such as truck, warehouse, depot, etc.

[0127] The application-selection method allows for the dynamic adjustment of domain and IP addresses under application control across APGs and networks.

[0128] A further embodiment of the present invention involves the access points-assignment of domains and server-assignment of IP addresses. This method is suitable when the manual assignment of domains and IP addresses is impractical due to many mobile units 21 or due to the complexity of the network.

[0129] AP-assignment of domains requires configuring access points 170 to allow for an automatic configuration. Using the access point 170 access control list (ACL) features, security can be enhanced by giving the access points 170 a list of the MAC-layer addresses of all the mobile units 21 allowed. This list can be larger than the number of mobile units 21 actually being serviced at any given time, allowing the timesharing of the capacity of the access point 170 among a large set of intermittent use mobile units 21.

[0130] Server-assignment of IP addresses requires the existence of a mechanism within the protocol stack, sup-

[0144] Different users of such a system can freely exchange information because the interface information needed to process the data files is distributed on a label along with the data files themselves. Each user no longer needs a copy of the specialized application program that was previously required to read the data label.

[0145] According to another aspect of the invention there is provided a bar code scanning OLE (Object Linking and Embedding) COM (Component Object Model) object for communicating commands and bar code data over a wireless link. As discussed in more detail below the object uses OLE automation to be a "plug-in" development OLE control extension. It thus becomes an in-process OLE automation object. The in-process OLE automation object controls a bar code scanning device over a wireless link on a remote client. The remote device enables a bar code reader and collects the bar code information, returning the data over the wireless link to the OLE automation object.

[0146] The general principles of OLE architecture will be well known to the skilled man. In the present embodiment, a scanning object is implemented as an OLE control. OLE controls are re-useable software components designed to work in containers that support OLE 2.0. OLE controls are more powerful and more flexible than previous systems such as VBX Custom Controls in particular as, unlike the VBX Custom Controls that they are replacing OLE controls support 32 bit environments and are not limited to Microsoft Visual Basic (Trade Marks).

[0147] OLE controls are designed to work in any container that supports OLE 2.0 including not only Visual Basic 4.0 and beyond but also OLE-enabled container applications such as Microsoft Office (Trade Mark). Additionally OLE controls work in third-party OLE-enabled applications in development tools.

[0148] OLE architecture enables different software objects to communicate to each other using a binary interface mechanism. This allows software objects to be developed separate from each other and bind very late at run time. The software interface is a contract between the container and the control on how the two software objects will interact and exchange information.

[0149] Under the OLE architecture, the scanning object can be placed and activated in any of a variety of containers that support the OLE container interface. Fig. 19 shows the general mechanism between a control 401 and its container 402. As can be seen the mechanism includes standard compound document interfaces 403 and additional control interfaces 404, each comprising multiple interfaces.

[0150] In such a system the scanning control appears to become a seamless part of the container's environment. Through the exposed interfaces the two objects communicate and integrate with each other.

[0151] In addition, as shown in Fig. 20, the scanning control 401 communicates over a wireless link 410 with a remote computing client 411 to control the bar code reading device 412. The scanning control 401 sends commands over the wireless link 410 by creating separate threads of execution 413a to 413d that send, receive and synchronize bar code reader transactions over the wireless link. As shown in Fig. 20, the OLE container 402 and control 401 communicate via lines 414a to 414f The OLE control includes a main control thread 415 which communicates with the OLE container 401 via lines 414a,414b and with a first transaction thread A 413a via a line 416. Each of the transaction threads 413a to 413d communicate along a respective line 414c to 414f with the OLE container 402. Each of the threads also outputs through a respective first line 417a to 417d to a transaction start dispatch function 418 and receives an input via a respective second line 419a to 419d from a transaction complete dispatch function 420. The transaction start dispatch function 418 communicates with a transport layer 421 in the remote client 411 via a line 422 and a transaction complete dispatch function 420 receives input from the transport layer 421 via a line 423. The remote client 411 includes a corresponding transport layer 424 which outputs via a line 425 to a data arrival handler 426 and receives an input via line 427 from a command complete handler 428. The data arrival handler 426 outputs via line 429 to a bar code device driver 430 and the command complete handler receives an input 431 from the bar code device driver 430. The bar code device driver 430 communicates with the scanning hardware such as a bar code reader 412 via a line 432.

[0152] As a result users can develop applications using OLE-enabled development tools like Visual Basic 4.0. The user simply inserts a new scanning object into their project, sets required properties, writes necessary code for event notification and the scanning control seamlessly talks to the remote client bar code scanning device over the wireless link. To the application program it appears as if the scanning device is resident on its local hardware. The invention comprises a significant development over previous architectures comprising implementation of a local bar code scanner resident on a machine running a COM object. In particular the architecture of the invention allows control of the scanner through the wireless interface.

[0153] By virtue of the present invention there is in addition the capability of supporting future versions to be distributed via the distributed component object model architecture (DCOM). The interfaces between the control container and the control itself are binary and can be implemented by the operating system as Remote Procedure Calls (RPC's). Accordingly the OLE control can be implemented as an Active-X control to control devices over an Internet or Intranet link. This technology allows Web authors and developers to create a new generation of interactive Web pager and applications, for example Microsoft Internet Explorer 3.0 (Trade Mark). This implementation is of particular benefit in proposed systems whereby users will wish to integrate bar code scanning capabilities into their Intranet/Internet-enabled applications.

software allowing creation of a web site at the terminal. The web site can contain, for example, recorded images or sounds from the environment of the terminal together with text input at the keyboard and/or the user's recorded verbal commentary. A further feature that can be incorporated into the terminal is a global positioning system (GPS) of a known type. The GPS communicates with GPS satellites via a suitable antenna (not shown). As a result the specific geographical location of the mobile device can be immediately ascertained. This can be provided as additional information broadcast by the device and can also be used by a central tracking system to ascertain where all the devices are at a given time. Once again specific details of the various individual components will be well known to the skilled reader and, for the purposes of clarity, are not repeated here.

[0164] In order to minimise costs the network architecture is designed to minimise the amount of data traffic over the highest cost communication links. This can be done for example by selecting a communication route which utilises the cheapest available lines. Where this can lead to delay a prioritisation system can be introduced ensuring that communications in respect of which delay is unimportant can be sent on a cost optimised basis whereas those signals for which the speed of transmission is important are sent on a urgency basis. For example where wireless communication gives rise to high costs as against physical interface communication, low priority information can be downloaded physically from the terminal to a cradle to reduce the power and processing burden and general cost burden.

[0165] An alternative terminal configuration can be based on the arrangement disclosed in US Application Serial No. 08/691,263, filed August 2 1996, assigned herewith. That specification describes a modular type terminal having interchangeable data collection modules, together with a detailed discussion of communications between mobile units and the Internet.

[0166] The system can be used for coverage of news events. A journalist holding the terminal can store images of a news event, and record a report on the event. A web site can be instantaneously set up at the terminal via the internal server holding the report and other data. Accordingly a user wishing to find out about the news event merely needs to access the site via the network. The address could be known to the user or could be available from a central site on the Internet disclosing where various mobile units are located, and providing their site addresses. It will be seen that the technology could further incorporate a pay-per-view type system whereby the user is automatically billed for accessing the site. It will be seen that many other applications can be envisaged. For example a police report of the scene of an incident, or an insurance operative report can be accessed actually on location at the incident rather than relying on transfer to a stand-alone server for creation of a web site at that level.

[0167] According to the embodiment any suitable form of wireless communication between the client/server and the Internet can be utilised. Such systems are well known for roaming units, whereby access points to the Internet arranged to receive communications from mobile units are located at various geographical points. Known algorithms can be used for selecting which access point is the most suitable. The communication can itself be by radio waves or an optical link such as an IRDA Standard Protocol. It will be seen that another of the advantages of the system is that the site is stored at the terminal and need only be down-loaded on demand via the wireless link thus reducing the cost that would be incurred by transferring data continuously. Data that is never requested can be transferred over a less costly connection at a later time.

[0168] Referring to Fig. 2d a flow chart of the operation of the terminal 501 is shown. At step 5110 the desired data, for example an image or an audio recording is captured. The data is then encoded at step 5112 into a suitable format to be rendered as a web page, for example by creating a bit map. At step 5114 the encoded data is processed to create a suitable web page according to the desired format, as determined by the server software and any user input. The process can then branch to step 5116 where the page is stored at the terminal. When a page access request is received at 5118 by a remote user called up the known address for the terminal the page is displayed at the terminal web site. According to an enhanced system, the process branches at 5114 also allowing a specific page address to be created for the particular data stored in the given process, at step 5120. The address and details of the page stored at the address are displayed on a home page at step 5122. This allows a menu to be created for the terminal such that more than one page is available. Accordingly when the site is accessed at 5124 by a remote user the remote user has the option of selecting the relevant sub-page displayed at the home page at step 5126, allowing display of any desired page, returning to step 5120. The system thus allows quick and easy operation with no programming required and in particular no HTML requirement. An instantaneous web page can be set up using the server software, the image to be displayed being stored simply by pointing the terminal at it and "clicking". Once again, the system can be designed with cost optimization in mind, ensuring that a minimum amount of data traffic occupies high-cost communication links.

[0169] Referring to Fig. 3b one possible implementation of an alternative embodiment of the present invention is shown. Where, for example, the police or other authorities, or an insurance operative wish to record details of a scene shown generally at 530, the image is captured as a still digital camera image by the data terminal 510 in the manner discussed above. The stored image is encoded, for example as a bit stream and the bit stream is transmitted or relayed via the transmitter 518 to a remote point.

[0170] In the embodiment shown the image information is relayed from transmitter 518 to an intermediate booster transmitter 532. This can either be one of a network spread across an area or can, for example, be carried in the data

[0178] Yet a further possible implementation of the arrangement would be as a remote fire alarm or smoke detector. A terminal including the basic components of a digital camera or other image recordal means and network connectivity can be permanently or detachably mounted at a zone where it is desired to monitor for fire, smoke, poisonous gases or any other such hazard. The terminal further includes a hazard detector of any suitable type such as a smoke detector, a heat detector, a noxious substance detector or other. All these detectors are well known to the skilled man and do not require further description here. In the case, for example, of a fire alarm terminal, when a heat detector detects that the ambient temperature has risen over a preset limit the terminal is activated to capture a still or moving image of the scene. At the same time the terminal notifies the relevant authorities such as the fire services and the image is transmitted in a manner discussed above to an access point at the fire station. Accordingly the scene can be reviewed and it can be assessed whether a true fire risk exists or whether other activity to which the increase in temperature is attributable can be detected such as cooking activity. As a result false alarms can be to a large extent avoided. It will be seen that a similar approach can be adopted for other hazard detectors, where an image of the scene is transmitted to suitable authorities when a potential risk is first detected for further assessment before full mobilisation.

[0179] A further implementation for which the system of the present invention according to a further aspect would be particularly suited and which would benefit from the advantages discussed above is in the field of goods transfer, for example parcel delivery. When a damaged parcel is received there is no way to know immediately the condition of the parcel when shipped. The system of the present invention would, however, be able to acquire the image and transmit it to a remote location or create a suitable web page on site. The image could then be accessed at the receiving depot and compared with the actual received parcel to establish whether the condition had changed in any way. An alternative option would be to print the image information in a bar code format, the bar code itself being attached to the parcel itself. The bar code symbol could be decoded at the receiving depot, once again to compare the image with the received parcel. Evidently a high resolution bar code symbol will be required, for example under protocol PDF 417. The reader shown in Fig. 3a includes the capability for such an arrangement including a printer and printer slot 526.

[0180] It will be appreciated that the embodiments described above relate to specific possible implementation of the invention, and that the invention embraces a number of alternatives. For example, as shown in Fig. 5 the data terminal 510 is configured with ergonomic considerations in mind, fitting comfortably into the palm of the user's hand. As a result the data terminal 510 can be quickly and accurately directed towards an image to be recorded, using the visual display screen to ensure that the image is as desired. At the same time the keyboard can be manipulated comfortably using the user's other hand to capture the image, input additional information and so forth. Alternatively the terminal may be in the form of a conventional camera, or a video camera, or any other appropriate configuration allowing image capture, and, preferably, data input.

[0181] The digital camera preferably includes auto focus capabilities and manual zoom capabilities with a separate button/trigger for zooming, which button/trigger may form part of the keyboard or may be provided separately. The manual zoom feature will assist in taking close-ups of the subject to be imaged. As mentioned above, a printer, for example a low density, low quality printer can be included in the data terminal, or provided as an add-on, so that a hard copy of the image is available in the field. As also discussed above, the image could be printed in PDF 417 format for subsequent decoding.

[0182] Fig. 8 shows an alternative configuration for a data terminal. The terminal 510 contains generally all of the components discussed in relation to the other embodiments herein. However the terminal 510 is configured in a "point and shoot" design and includes a grip portion 5120 and a barrel portion 5122. The grip portion is configured to sit comfortably and easily, with optimum balance, in the user's hand and further carries a trigger 5124 and a thumb wheel 5126. A display 5128 and optional keypad 5130 are provided on the upper face of the barrel portion 5122 to allow easy viewing and input access to the user. The camera lens or other image recordal means are provided on the front face of the barrel portion 5122 (not shown) allowing the user simply to point the terminal 510 in the direction it is desired to record in. When the desired scene is viewed on a display 5128 capture is effected by activation of the trigger 5124. Zoom can be controlled by the thumb wheel 5126 which is preferably located for optimum ease of use by the user's thumb when the grip portion 5120 is held by the user.

[0183] The processing speed and storage capabilities of the components of the data terminal can of course be determined according to the eventual cost of the system, for example a slower and hence cheaper microprocessor can be incorporated. For more high-end applications the data terminal could additionally include an SRAM card to store the still images. In addition the visual display screen 514 can, as shown in Fig. 6 include LCD (liquid crystal display) capabilities. Accordingly using a suitable pen 100, the image can be altered for example by ringing or otherwise highlighting areas of interest the alterations being represented on the LCD display as 5102 in Fig. 6. The alterations can be deleted or revised additionally using the keyboard as appropriate.

[0184] The range of implementations, and the speed and efficiency of the system can be further enhanced by also incorporating bar code reader capabilities into, or in conjunction with, the data terminal. The construction and applications of bar code readers will be well known to the skilled man and do not require a detailed description here. Briefly, however, a bar code symbol comprises one or more rows of light and dark regions, typically in the form of rectangles

in width, in order to show more clearly each of the principal components and how they interact. In the embodiment shown, the wand reader 690 comprises a ball-point pen 691,692 together with the optical reader 693 itself. The wand reader need not actually have writing capability, or may be in the form of any suitable writing implement such as a pencil, a fountain pen, a marker pen and so forth. Indeed the optical reader sub-system discussed in more detail below can be in a modular form insertable into a suitably configured writing implement housing of any desired type.

[0196] The writing element of the wand reader 690 is shown schematically as a ball-point pen cartridge 691 together with a projection/refraction mechanism generally designated 692 and of any suitable known type. Evidently it is desirable to reduce the size of those elements 691,692 as far as possible to allow maximum space for the reader module.

[0197] The reader module is generally designated 693. The components and construction of the module 693 will be generally well known to the skilled man and are described only briefly hereafter for the purposes of completeness. The reader module 693 includes a light source 694, for example, a laser or LED and a reflector 695. A reading beam generated by the light source 694 is reflected by the reflector 695 out of a reading window 696. The reading beam is reflected by a bar code symbol generally designated as 697, passes once more through the reading window 696 and is received by a detector 698. Preferably the reader module 693 is a field of view reader in which case the mirror 695 is a fixed mirror and the detector 698 comprises a CCD (charge coupled device) array. Of course in certain implementations a scanning system may be used in which case reflector 695 is driven by a motor schematically shown at 699 for scanning motion. The light source 694, detector 695 and, if appropriate, motor 699 are connected to a processor, control and data storage element 6100 in conjunction with a power source 6101. The processor element 6100 controls operation of the various components and also acts as a data storage and processing device for bar code information read by the module 693. As discussed in more detail below, it is desired to down-load the information stored in processor element 6100 at a later stage to an external device. Accordingly a data output port 6103 is provided fed by line 6102, preferably adjacent to or in conjunction with the reading window 696. The wand reader 690 may also be used as a laser pointer in one embodiment, wherein the output reading beam is used to highlight desired elements during a presentation.

[0198] A particular implementation proposed according to the present invention for the wand reader 690 occurs in relation to consumer information access as shown in Fig. 23a. For example where a consumer 6120 carries a wand reader 690 and is in a retail outlet selling products 6121, each of those products may carry a bar code symbol 6122 for example in UPC format. The consumer 6120 may be interested in purchasing the product 6121 but may not be willing to commit until further information is available. There exists, therefore, a risk that the consumer will forget about the product or, as previously, it may be necessary to rely on a consumer 6120 chancing upon the product or additional information relating to the product, and his memory being jogged accordingly.

[0199] According to the present invention, however, the consumer 6120 can read the bar code symbol 6122 using wand reader 690. The bar code information is stored in the processing element 6100 and, to the extent desired, processed. In particular, information contained in the bar code symbol 6122 relating to the product 6121 is stored. As a result the consumer has an automatic reminder of the product he wishes to purchase as well as information relating to the product. Evidently, where the consumer 6120 sees more than one product of interest, the relevant information can also be stored, the storage capabilities of the wand reader 690 being limited only by the storage space in the processor element 6100.

[0200] A particular implementation of the present invention allows the consumer to subsequently down-load the information stored in the wand reader 690 in a manner described in more detail below. In particular the information can be down-loaded to a personal computer or other access point to a computer or data network. The down-loaded information can then be used in various different manners. For example the product can be ordered or additional information concerning the product can be accessed. A particular implementation proposed under the present invention is that the bar code symbol accompanying the product contains sufficient information for the personal computer or access point to the computer network to access a site on the ad (or comparable data storage system). This site can contain additional information concerning the product, information concerning related products, price information, cross-references to further related sites, and the capability of ordering and paying for the product. This greatly simplifies the purchasing process, allowing for example a price check and also ensures that the consumer does not forget a product which has caught his attention.

[0201] In addition, further information can be derived according to the present invention. For example the popularity of the product can be assessed for future marketing purposes. Preferably the reader wand 690 has a dedicated user and carries user identification information such as credit card number, or other identification carried under an approved system. As a result, during purchase of the product details of the transaction can be based on that information. In addition a customer profile can be built up based on the consumer's buying patterns.

[0202] The access point can be located within the retail outlet allowing the consumer 6120 to access the information on site and make a purchase decision before leaving the retail outlet. Suitable access points are discussed in more detail below. It will be seen that the bar code symbol can be carried on the product, or as shown at 6123 on the shelf

used as for Fig. 24. It will be seen that the exit window for the reader (here shown as a laser scanner at 6131) is in an inclined face relative to the longitudinal axis of the reader wand 6130, allowing improved ergonomics in reading a bar code symbol. The reader further includes a grip 6133, for example made of leather, around a portion of its length allowing improved user grip and comfort.

[0210] Fig. 26a and 26b show a further alternative configuration schematically once again using the same reference numerals where appropriate as in Figs. 24 and 25. Various methods of down-loading the information are contemplated. Two approaches are shown in Figs. 27a and 27b. In a preferred configuration shown in Fig. 27a a personal computer is shown at 6150 being of the portable type although a fixed type PC will also of course suffice. The personal computer 6150 includes a keyboard 6152 and a screen 6154 and can generally be of conventional type. The personal computer 6150 includes a data input port 6156 arranged to communicate with the wand reader data output port 6103. In the embodiment shown, the output port 6103 of the wand reader 690 is touched against the data input port 6158 on the personal computer 6150. Touching the input port 6156 firstly commences the down-loading sequence and secondly allows accurate and rapid communication between the wand reader 690 and the personal computer 6150. The interface between the wand reader 690 output point 6103 and the data input port 6156 can, for example, be of the "memory button" or "touch memory" type for example as sold by Dallas Semiconductors. The actual interface is of well known type and in effect the information stored in the wand reader 690 is communicated to a memory button 6103 provided at an appropriate point on the wand reader 690. The information is converted to a suitable form for transmission at the memory button 6103 and, on contact with the data input port 6156 of the personal computer 6150 the transmission is activated. The data input port 6156 is configured to receive and convert into a suitable form information transferred from the memory button 103. In particular the information can be transferred in the form of a series of electronic pulses representing bits. Such a system gives rise to a simple and substantially error-free interface allowing a user to down-load information stored in a reader wand 690 to a personal computer 6160 quickly and accurately.

[0211] As will be appreciated, various other down-loading methods are contemplated within the ambit of the present invention. For example as shown in Fig. 27b a fixed-type personal computer 6160 including a keyboard 6162, a display screen 6163 and a mouse 6164 includes a microphone 6166 which receives an audio signal from a corresponding speaker data output 6168 on a reader wand 690. A button (not shown) or other switch can be included on the reader wand 690 to activate transition by the speaker 6168. The information stored in the reader wand 690 is converted to a high frequency audio signal at the speaker 6168 which is received by the microphone 6166 and decoded. Of course the transmitter can transmit other forms of radiation, for example it can be an optical or microwave transmitter with a suitable receiver being provided on the personal computer.

[0212] Where the transmitter is optically based it can utilise IRDA (infrared) standard communications implementation as will be known to the skilled person and as currently available on many "laptop" computers. The optical transmission can be at the "blink" (repetition) frequency of the pen illumination source.

[0213] Yet a further down-loading system is shown in Fig. 28. A dedicated data down-loading port 6170 includes an orifice 6172 for receiving a reader wand 690. The port 6170 communicates information down-loaded from the wand reader 690 via a line 6174. Referring to the sectional view shown in Fig. 29, it will be seen that the port 6170 includes a data receiving interface 6174 of any of the types described above which communicates with the reader wand 690 for down-loading of information. Down-loading can be contact activated by contact between the wand reader 690 and the interface 6174 or activated by pushing a button or other switch (not shown) on the wand reader. The interface 6174 communicates with a processor 6176 for converting the down-loaded information if necessary into a format appropriate for a computer network, and the information is communicated to the computer network via line 6173.

[0214] It will be appreciated that line 6173 can comprise a wireless link or a telephone line,in which case an appropriate modem can form part of the port 6170.

[0215] It will be seen that all of these methods comprise a user-friendly system for down-loading scanned information from a wand reader. Use of a data well-type port of the type shown in Figs. 28 and 29 is particularly suitable where it is not desired to rely on the consumer having a PC or other home access to a suitable computer network. The port can for example be provided at a retail outlet or other point of sale. It should be noted that the wand reader can also be writable via the data port, personal computer or other means (even a bar code symbol itself) to input user information of the type discussed above. This would facilitate short term usage of a wand reader allowing a given user to input information temporarily for the duration of his or her use of the wand reader.

[0216] In an alternative ergonomic embodiment the reader includes the components discussed generally above but is in a slightly different configuration. Referring to Fig. 30a and 30b the reader 6200 is approximately the size of a conventional pen but, in cross-section to its longitudinal axis, is substantially square. Furthermore a scanning window 6202 is provided substantially at the top of one of the side faces rather than at the end itself. Referring to Fig. 30b it will be seen that an alternative reading configuration is thus achieved whereby the reader 6200 is held substantially parallel to, rather than substantially perpendicular to a page 6204 to be read. Preferably in its embodiment, a display window 6206 and on/off trigger 6208 are provided substantially at the top of the opposing side face. As a result the trigger 6208 can be controlled, for example by the user's thumb, with optimum ease for ergonomic reading. Similarly the display 6206

centralised control of the other components as discussed above and below, together with general operational conditions of the terminal, data and power checks, compatibility checks and so forth as appropriate.

[0230] Shown separate from the processor 724 is a memory 726, although this may be incorporated in the same unit as the processor 724. The memory 726 allows long or short term data storage for example of data received at the user or other input 716,718, via the remote link 722 or, as discussed in more detail below, via the cradle interface. Memory control, management and transfer can be controlled by the processor 724.

[0231] The cradle interface 728 allows downloading of data stored in the terminal 710 to the cradle 712 as well as transfer of control or other data from the cradle 712 to the terminal 710. Information to and from the cradle interface 728 is processed by the processor 724 as appropriate. As discussed in more detail below, the cradle/terminal interface is a physical interface which operates during, and can be enabled by, insertion of the terminal 710 into the recess 714 of the cradle 712.

[0232] The cradle 712 also includes various components shown in block form in Fig. 32a, both arranged to deal with control and communication with the terminal 710 as well as communication with the host and other peripheral functions.

[0233] The cradle 712 includes a processor 730 for controlling the remaining components as discussed below as well as operational conditions of the cradle 712 and general communication needs between the cradle 712 and the terminal 710, between the cradle 710 and the host 715 and, where the cradle acts transparently, between the terminal 710 and the host 715.

[0234] The cradle further comprises internal memory 732 and external memory 734. Both of these are for storage of information received from the host 715 and/or terminal 710 for transfer between the two, as controlled by the processor 730. The internal memory can, for example, comprise part of the processor unit 730. The external memory 734 preferably makes use of external storage devices such as disks etc.

[0235] The cradle 712 communicates with the terminal 710 by virtue of a terminal interface 736 communicating with the cradle interface 728. The terminal and cradle interfaces are preferably physical interfaces as discussed above. Information to and from the terminal 710 can be controlled via a processor 730. The cradle 712 further comprises a host interface 738 for communicating with the host 715. The interface can be a wired interface or a wireless interface of known type as appropriate. A communication controller 740 can also be provided additionally to control the various communication protocols between the terminal 710, the cradle 712 and the host 715.

[0236] A remote link 742 is provided in the cradle 712 for communication with the remote link 722 in the terminal 710. The communication can, as discussed above, be any wireless means of communication such as infrared IRDA, radio or microwave.

[0237] The cradle 712 can also include various peripherals of standard types found with computers generally such as a printer 744 or other component such as an enlarged display, a modem link to a remote host, additional storage or processing capacity and so forth.

[0238] The cradle 712 communicates via the host interface 738 with the host 715. The host 715 can be a standalone computer or part of a local area network such as the Intranet. The Intranet can itself be part of the Internet or another wide area network, and if appropriate suitable security measures such as a "fire wall" can be put in place.

[0239] Numerous applications and advantages are provided by the system shown in Figs. 31, 32a and 32b. In particular, all of the advantages of a hand-held terminal are available, such as portability, ease of use, and suitability for mobile uses. Particular applications include inventorying, monitoring of transported goods, point of sale use, stock exchange formulations, auctions and so forth. Because the cradle includes a data interface, information input to the terminal, for example as keyboard input or barcode input can be stored short-term in the terminal and transferred at regular intervals to the cradle when it is inserted in the cradle. Once the information is downloaded the memory in the terminal can be cleared. At the same time control or application data can be transferred from the cradle to the terminal such that the terminal application can be changed or updated as desired. The cradle further preferably includes a battery charging module which connects with the terminal when it is inserted into the cradle to allow simultaneous battery recharging. This option is discussed in more detail below.

[0240] The cradle then communicates the downloaded information to the host, and allows communication of update/application information from the host to the terminal.

[0241] Accordingly the system allows rapid updating of the host data base with information from the terminal whilst requiring reduced memory capacity in the terminal. At the same time the cradle allows significant time-efficiency benefits, both in reducing user involvement in data transfer to a minimum and in allowing the utilisation of user down-time to download information. The remote link further allows immediate update capability where necessary, at the same time allowing this capacity to be kept to a minimum (by virtue of the regular downloading sessions) giving rise to a corresponding reduction in power drain.

[0242] As discussed in more detail below, particular benefits of the invention lie in a system in which the basic system described with reference to Figs. 31, 32a and 32b is enhanced, and memory/computing tasks distributed so as to allow maximum flexibility and minimum demand on the terminal 710. Known hand-held computers are continually being updated and redesigned to allow maximum memory capacity, data storage and application availability. Generally this

collection. For example the terminal 710 can include a reader component 752 which can be integral as shown or modular. The reader 752 is arranged for laser scanning of graphic indicia such as barcodes and includes the basic component features of a reader, namely a reading beam emitting means such as a laser diode, a reflected reading beam detecting means and means for scanning the beam if that is desired, for example an oscillating mirror (in the case of a "flying spot" optical scanner). If the scanner is a "field of view" scanner, on the other hand, no scanning means is required, and the detector comprises a CCD (charge coupled device) array. Data collected by the reader 752 is treated as "other input" shown in block 718 of Figs. 32a and 33 in relation to the terminal, and the data is processed accordingly.

[0251] In addition the terminal 710 can include a data pen 754. Such features are known in the art. In particular the data pen 754 can be used to write directly onto the display 750 of the terminal 710, either for data entry, for signature capture and verification or other appropriate data collection and verification purposes. The terminal 710 also includes an audio speaker 756 allowing alarm signals and/or other audio messages such as voice synthesised speech or human voice to be output by the terminal to the user, as well as an audio input such as a microphone for example for two-way voice communication.

[0252] Figs. 34b to 34f show an alternative terminal implementation 745. The terminal 745 includes a display 746, controls 747a,747b and a speaker 748. The terminal is arranged for wireless communication with, for example, a local Intranet network. Messages to the terminal 745 are displayed on the display 746. Simple messages can also be relayed from the terminal 745, alternatively the terminal 745 can relay basic information as to location or user identification. Preferably the display 746 is an ICON based display in which, for example, the user is able to select messages to be relayed to the network by scrolling between suitable icons using control buttons 747a,747b. The terminal 745 can also include audio capability either emitting a short "beep" type signal when a message is received or, in more sophisticated versions, incorporating a voice synthesizer which can notify the user that a message has been received or indeed speak the message. The terminal 745 can also include a microphone (not shown) allowing audio messages to be relayed to the network via the terminal 745. For ease of use the terminal preferably also includes a clip 749 allowing it to be releasably attached to a user's clothing.

[0253] The system preferably incorporates power management/distributed power management to ensure that, for the portable components at least the power supply is as efficiently used as possible ensuring that the full life of a power supply is obtained. In particular where the terminal is capable of performing different tasks using different components, the power usage for each component is preferably distributed by individual adjustment in relation to each component to optimise power demand to meet the necessary power requirements.

[0254] A retail application of the invention is shown in Fig. 35. A customer 760 enters a retail outlet such as a supermarket (as shown), or any other suitable store selling merchandise or products. The retail outlet automatically provides a plurality of portable terminals 710 stored at a convenient location in their respective cradles 712. The customer 760 selects a terminal 710 from a cradle 712. As shown the retail outlet sells a variety of products for example at shelves 762 or counters 764. Also provided in the retail outlet are a plurality of radio or other suitable wireless transmitters or access points 66, at appropriate locations.

[0255] As the customer 760 moves about the retail outlet the access points 766 broadcast to the terminal 710. The terminal 710 uses known prioritising systems and/or algorithms to accept signals only from the nearest access point 766. The access point 766 transmits information concerning products available in the locality of the terminal 710 for display on the display 750. The terminal 710 receives the signals via the remote link 722 shown in Fig. 32a.

[0256] The information transmitted by the access point 766 to the terminal 710 can take various forms, and in one preferred embodiment the terminal displays graphic icons representing products available in the locality, as shown in Fig. 36. For example where the consumer is in the vicinity of the laundry section and the terminal 710 selects the broadcast signal from the nearest access point 766, products available in the laundry section can appear on the terminal display 750 such as dishwashing or normal washing up liquid, 770, 772 respectively. Actual pictorial representations of the products can appear for the customer's ease of reference. Accompanying information such as price, location and any special offers can also be provided at 774. Accordingly, the retail environment can be tailored for optimum efficiency.

[0257] Either a dedicated access point 766 or each of the plurality of access points 766 can also provide, for example, a map of the retail outlets and the products found as shown in Fig. 37. Optionally the map could include a marker 776 indicating the current location of the user - this could be approximated by establishing which access point was currently in communication with the terminal, or a simple geometric positioning system could be used. Indeed such a positioning system would further allow broadcasts to the terminal to be dependent upon the customer's position as established by the positioning system rather than as determined by the location of the closest access point.

[0258] The terminal can include a preliminary option screen, as shown in Fig. 38a, which is displayed to the customer when the terminal is first accessed. Various icons are shown depending on what functions the customer wishes to utilise. The icons can be accessed and processed by the customer in various known ways, for example by using an integral "mouse" type roller on the scanner, by having a touch-sensitive screen, by having a "digital pen" arranged to interact with the screen or by using a keyboard on the terminal. The icons can include the following: personal identification information entry 780, map 782, product information 784, current offers 786, products in the user's vicinity 788, ter-

stacker, inventory officer or other relevant personnel could enter their user identification information to the cradle prior to removing the terminal such that the terminal is initialised appropriately. It will be appreciated that the same system could be used for inventorying in warehouses or general product tracking, using graphic icons to represent the products and allow quick, user-friendly accessing of background, ordering or destination information.

[0270] It will be seen that a variety of other peripheral features can be envisaged for the system. For example the system can include a range alarm such that if a terminal is taken outside the store, or outside the designated area within the store, an alarm will sound. For example if the customer carrying the terminal strays into an area where no access points are available or where access is generally restricted to staff then the alarm can sound. The alarm is provided within the terminal and can operate, for example, on the basis of range signals from the closest access point to establish whether it has exceeded that range in which case the alarm will sound.

[0271] The terminal can be used in conjunction with a "self-scanning" system by the user whereby the user scans those products purchased personally, removing the need for check-out personnel and generally accelerating the shopping process. In that case the terminal can store the purchasing details against the user identification information - where appropriate - to update data bases on the particular customer's marketing profile. The scanner can also be used to read codes directly from products in order that additional information can be called up at the terminal.

[0272] The system described above is particularly useful for "ultra thin" clients in the form of portable terminals. The basic capabilities that must be carried on the terminal itself are the display driver, minimal memory and processing requirements and communications capabilities and protocols for communication both with the access points and the cradle. Information concerning products, maps and other relevant aspects can be accessed on demand via the access points from a host. Data stored concerning a given customer's buying patterns and, as appropriate, queries and other transactions can be downloaded to the cradle after each use, reducing the memory requirements considerably. Similarly, the exact functions required for the terminal e.g. customer use, inventory use, re-stacking use and so forth can be loaded from the cradle once the use has been identified whilst the terminal is still stored in the cradle. As a result the memory and processing burden on the terminal itself can be kept to a minimum, allowing simplicity and reduction in costs, as well as ease of updating applications and so forth.

[0273] In an alternative arrangement each terminal can communicate with its respective cradle if the store is of suitable size. Accordingly the ultra-thin client-thin cradle implementation can be achieved.

[0274] The system can be yet further enhanced in various manners. For example the terminal could incorporate a detachable scanner portion, such that the scanner and/or terminal are each autonomous and independently accessible. In some circumstances the capabilities of the terminal itself or the scanner itself will only be required and the additional burden of the other components would not be desired. This would be the case for example where a portable digital assistant was required.

[0275] A further possibility would be that of adapting the display format of the terminal. This would preferably be incorporated as a software facility in the cradle, rather than burdening the terminal with the capability. The display format - i.e. the number of characters in the horizontal direction - could be adapted to the horizontal length of the screen of the terminal. To make the system as user-friendly as possible it would preferably be the case that the terminal communicates the display dimensions to the cradle such that the server/cradle could automatically format the display page to fit the screen without the requirement for "wrap-around", that is, an intended single line of text being split into two or more lines. As an alternative to automatic formatting, a predetermined selection of available predefined format options could be accessed, and the suitable option adopted. An alternative method of avoiding wrap-around for text lines would be to scale the text down to create a smaller typeface size allowing a single line accommodated without wrap-around.

[0276] In addition to its downloading/uploading/ initialising security and storage capabilities, another important function fulfilled by the cradle is a battery recharging function. Whenever the cradle receives a terminal, a battery level check is carried out and if the batteries are below full power, or a predetermined threshold power level then recharging will automatically take place during the down time of the terminal. The terminal carries suitable contacts arranged to mate with charging contacts on the cradle itself in a known manner. Battery recharging technology will be well known to the skilled person and is not described in any detail here. A charging configuration is shown in Fig. 39. According to this configuration the terminal 710 includes a rechargeable battery pack 7010 which is removably insertable into the terminal and includes suitable powering contacts 7012,7014 to cooperate with corresponding contacts in the terminal 710. The battery pack 7010 includes a plurality of power cells 7016 which are either permanently retained in the battery pack 7010 or replaceable to prolong the life of the battery pack as a whole. The battery pack 7010 is received in a charger 7020 which has one or preferably a plurality of battery pack receiving slots 7022,7024,7026. The charger 7020 is powered from a suitable power source shown schematically at 7028. This system allows multiple battery packs to be recharged at the same time, such that a plurality of terminals can operate on a fully charged battery pack whilst a replacement battery pack is being charged. This decreases the down time of the portable terminals to an extent limited only by the availability of battery packs and chargers.

[0277] The charger 7020 can be incorporated in a cradle or provided separately as appropriate.

[0278] It is necessary in any such arrangement to introduce adapter circuitry which determines the charging rate

[0288] In cases where the terminal is, or incorporates a cellular telephone an automatic facility can be provided in which the terminal/telephone operates over a wireless LAN as a preferred default option, but if the terminal is out of range of the access point (as defined by a predetermined level of communications reliability) the system uses the cellular telephone capability. Accordingly, the user can connect to the desired destination even if he moves outside the wireless LAN area, making the calling network transparent to the user whose only concern is that guaranteed communications are provided.

[0289] It is further desired to allow individual portable terminals to network with one another. This networking can be carried out using any suitable protocol, for example the system set out in the article "Routing in Ad-hoc Networks of Mobile Hosts", David B. Johnson, 1995 IEEE Pages 158-163. In particular a protocol specific to the network of mobile hosts is required taking into account the mobility of the hosts and the limited transmission range. A source host finds a route to a target host via intermediate hosts by broadcasting a query packet which records its route to the target host. The request pack carries a request identifier so that intermediate hosts ignore all but the first copy of the request packet. The total number of steps is limited. As a result the shortest path can generally be found with a minimum of communication overhead. Although the routes are discovered this way, the route may also be maintained and problems can arise where one of the intermediate hosts in the selected route moves out of transmission range. To overcome this route maintenance is carried out using a hop-by-hop acknowledgement system such that if there is a transmission problem this is reported back to the original sender and the route discovery system recommenced.

[0290] It is also desirable, in a mobile computer network, to ensure that the current location of the mobile terminal is known, not least for the reasons discussed above in relation to message routing. One method of doing this is to ensure that the current location of each mobile terminal is periodically communicated to a network centre. As a result a dynamically updated map of the location of all of the mobile terminals can be maintained which can be further used to determine routing of messages. Similar systems are known, for example, in relation to cellular telephone networks and systems. A suitable system is disclosed, for example, in US 5,612,703 which relates to a cellular communication system in which the position of a selected user unit can be determined by issuing a timing signal from a node, analysing a timing response signal from the user unit and determining the position of the user unit based on the round trip transmission and receipt time.

[0291] US Patent Application Serial No. 08/614,068 commonly assigned herewith and incorporated herein by reference relates to a portable terminal including a data input and data display and a motion detector. When movement is detected a controller activates relevant circuitry. For example where the terminal is sensed to be in a first positional orientation a first function can be performed whereas when it is sensed to be in a second positional orientation a second function is performed. It will be seen that this capability can be incorporated in the terminals of the present invention. For example it can be used to activate the terminal and deactivate it when it is removed and reinserted into the cradle.

[0292] Yet another preferred variant of the invention is shown in Fig. 40. In this case the terminal 710 is an ultra thin client relying on the cradle for the majority of the computing and processing burden. In fact the terminal 710 can be represented by two basic components, a notepad facility 7140 and a wireless communications component 7142. The exact details of these components are not shown in detail as they will be well known to the skilled man. Effectively the notepad facility allows the input of data to the terminal and display of relevant information at the terminal. The processing burden at the terminal is largely restricted to this basic input/output capability together with control of the wireless communications component 7142. The wireless communications component communicates with a corresponding component 7144 in the cradle 712. As a result raw data input to the terminal 710 is transmitted straight to the cradle 712 without the need for processing (other than for communications reasons) in the terminal, leading to a concomitant reduction in the processing and memory capabilities and thus power consumption of the terminal 710. Instead the bulk of the computing capability is held at the cradle, including a data processor 7146 incorporating memory space as appropriate, additional memory space in the form of for example disks, a printer peripheral 7150, and ethernet communications capabilities 7152 allowing the cradle to form part of a larger wireless network connected, for example, to a host itself part of an Intranet or having access to the Internet. In effect, therefore, the portable terminal 710 is no more than a display for a computer held in the cradle, communications being carried out via the wireless communications link using for example RF or infrared protocols or any other suitable link. Rather than communicating directly with the cradle the terminal can communicate with one or more nearest access points, each themselves communicating with the cradle, allowing a greater range for the terminal.

[0293] Such a system is particularly useful, for example, for dealers at a stock exchange or comparable implementations. The dealers can carry out their transactions using the hand-held displays, for example buying/selling stocks, keeping up to date with their current holdings and all other suitable transactions without the need for major processing, memory or power requirements in the terminal. When the terminal is not required it can be returned to the cradle for downloading of any further information that is required, for updating of its internal applications by the cradle and for battery recharging. As a result a useful, lightweight and highly mobile terminal is provided with the background applications expected from a full scale personal computer or equivalent.

[0294] Yet further implementations envisaged for the terminal include the provision of an AM/FM radio and/or

package recipient to sign for the package, noting the time of delivery. As the terminal/cradle is a server (in an alternative implementation the server software can be incorporated in the cradle with no loss in efficiency and a reduction in the processing burden on the terminal), and the server can communicate over a wide area network to the host or depot, an interface can be provided to the Internet allowing the sender of the package to determine at any time if the package has been delivered yet, or whether a delivery has been attempted but the package has not been received. Accordingly, the delivery company can set up an additional facility to attract and satisfy customers, giving instantaneous information, via the Internet, on the status of any delivery.

[0302] The detailed implementation of this can be carried out in various ways. For example the sender of the package can access the delivery company's website and then trace the progress of the particular package of interest using, for example, a code number assigned at the time of ordering the delivery. At the same time the progress of the package can be logged by the user, or delivery agent by entering the delivery or attempted delivery times against the code. The code can, for example, be read by a scanner provided in the terminal from the barcode provided on the package, if appropriate.

[0303] Logging of the progress of the package can be improved yet further by logging transfer of the package at intermediate stages between the sender and recipient, for example, at each stage of the depot chain. The development of a routing table is of particular importance in the general case where the exact route to be taken by the package via the depot chain is not decided at the time that delivery is ordered. This can facilitate double checking of the progress of the package. It is preferred that the routing table features details of the ultimate delivery truck as this will be easier to trace than individual packages. Preferably the sender pays a premium for this system of "instantaneous return receipt" so that the burden of transmitting the status of every package is reduced and need not be accessible on a real time basis except where paid for.

[0304] Referring to Figs. 43a and 43b a particularly useful implementation of a portable terminal is shown for use with the delivery implementation discussed above. In such implementations it is desirable for the user to have both hands free for delivery of packages. Accordingly a "pendant" type scanner 7170 is used, hanging around the user's neck. The terminal includes a scanner window 7172 angled so as to point in the direction of a package held at waist height by the user. Such a package is shown as 7174. The terminal 7172 is thus able to scan the package and any barcodes held on it with optimum ease. For simplified manipulation the terminal further includes controls 7176 and a display 7178 on an upwardly facing surface such that the user can manipulate the controls and read the display without having to remove the pendant scanner. The terminal 7170 can in addition communicate with, or interface with, the cradle 712 in the manner discussed above.

[0305] As discussed above any uses can be envisaged for the terminals of the type discussed above, including warehousing and generally logistics-type arrangements. The "thin client" system as described above is particularly suitable for incorporation with existing infrastructures including the hardware - PC's systems, networks and data tools, and software - databases and so forth which are already in place. This applies throughout the relevant areas of the market for example retail, distribution or manufacturing. Such a system will preferably incorporate a central server carrying a suitable database together with appropriate clients - for example wireless terminals of the type described above incorporating a graphical user interface to the user. The system introduces the benefits of real time operation which shortens the lead time on instructions and provides optimum implementation of both staff and hardware, at the same time allowing checking to take place on an immediate, continuing basis. Inventory information can be dated and processed in real time. Levels can be tailored accordingly and optimized/minimized. The user will automatically know where items are stored and be able to locate them promptly. At the same time the administrative burden is decreased. All of this is achieved without costly across the board changes to the existing hardware infrastructure.

[0306] The use of an icon based user terminal means that the system can be introduced quickly and with simple training only, but the system can also be extended to more complex systems including wave planning, resource scheduling, productivity measurement and real time assessment and ordering of jobs. As the inventory is continually updated there is no down time for physical inventorying. Management, data, inventory, stock and other relevant reports can be obtained at any time again decreasing the administrative burden.

[0307] A central server can run both client-types instantaneously. In addition to wireless terminals run via some form of radio network controller, PC's or other fixed terminals can also be wired to the system either at the base station or remote. Standard interfacing communications protocols can be incorporated together with standard network architectures to achieve a reliable, interchangeable and adaptable system preferably linked into other business systems as required.

[0308] Terminal/cradle arrangements of the type discussed above provide compact base stations allowing high speed data networking at the same time as battery charging for the terminals. The systems are appropriate for transportation and logistics companies, warehouse facilities, public safety, retail and other appropriate organisations. Preferably upon initiation, the cradle powers on and performs self-diagnosis to ensure proper system operation. Battery charging preferably begins automatically when the terminal is seated in the cradle and indicators such as LED's can be provided on the cradle to indicate when power is on and when charging is taking place. Data transmission can be

the Symbol Technologies Spectrum 24 pager and Modem. Accordingly further detail is not required here. The pager version includes the radio firmware, UDP/IP protocol stack, pager protocol interpreter, and pager user interface all running on a single 80188 CPU. the HTML runtime code has been designed to fit into this single task, polling model.

[0326] Known cradles have various basic requirements:

- Full hardware signal compatibility at the connect between the cradle and the host such that the host does not require modification, and full hardware signal compatibility with a serial port present on the terminal.
- Low insertion force connection between the terminal and cradle allowing frequent and preferably unlimited removal and re-insertion.
- Full hardware register compatibility within the terminal with existing communication software, for example IBM PC compatible communications software.
- Support for "chaining" of multiple cradles to a single host serial port. In one embodiment a "master" cradle is provided for connection to the host, and supports a large number of"slave" cradles. Two access modes must be supported, single access mode and multiple access mode. In single access mode, one terminal at a time receives exclusive control and the host serial port and all of the terminals experience results equivalent to "no cable attached". In multiple access mode, all terminals are granted receive access to the host serial port but the right to transmit is granted to only one terminal at a time. Both modes should support standard application software without modification despite the occurrence of multiplexing.
- The terminal/cradle should be implementable in a vehicle configuration as discussed above.
- It is proposed to use IrDA (Infrared Data Association) compatible optics for the zero insertion force interface to allow use of the terminal with readily available (non-dedicated) IrDA compliant peripherals and host computers.

Solutions to the various points are discussed below.

Solution 1

[0327] Each terminal comprises two pairs of optics (two transmitters and two receivers) as does each cradle. Accordingly two full duplex datapaths are provided. Each cradle contains a microprocessor plus two pairs of optics per slot (for receiving a terminal). In this four slots design, a single microprocessor handles all four slots. The primary optical channel between the cradle and a terminal carries the data part of a full IBM-PC compatible 9 wire series interface, for example TXD, RXD and SG. The auxiliary optical channel between the cradle and a terminal carries control information (DTR and RTS), status information, (DSR, DCD, CTS, RI) of a full IBM PC compatible 9 wire serial interface and bus information (BREQ and BACK).

[0328] The data interface is gated between the optics and the RS-232 by the cradle. The control and status information is communicated over the auxiliary optical channel. Within the terminal itself control, status, and bus information are used to produce the effects of single or multiple access mode as required.

[0329] Multiple 4 slot cradles could be chained together (up to 4 physical cradles, for 16 slots). The bus signals (BREQ and BACK) are passed as "tokens" from one cradle to the next to provide inter-cradle multiplexing.

[0330] The BIOS of the hand-held computer implements the cradle protocol and provides both IBM PC-compatible serial BIOS services and a proprietary extended serial BIOS service set. Since few, if any, IBM PC-compatible serial communications program use either set of BIOS services (instead of going directly to the hardware), communications via the cradle cannot support standard communications applications. Since this is also true of the physical serial port this is not a particular hardship. A single slot version of these cradles has all the same functionality of the 4 slot versions except it does not support chaining. Since only one slot is present and the chaining logic is not required, the hardware design is somewhat simpler. The two optical channels are handled identically, however, and the terminal BIOS code is the same.

[0331] An alternative single slot configuration is simplified and does not include chainability or an optical interface. A modular (phone jack) style of connector can be used to provide either cabled serial communications (via an adapter cable) or can be used as the cradle "docking" connector, which provides a wired path for both of the data channels that are normally optical.

[0332] To improve IBM PC-compatibility an alternative approach can be used to emulate the IBM PC serial communications interface. This involves "bridging" the control and status information (conditioned as appropriate based on bus information) between the auxiliary optical channel and the "emulated" UART registers. This bridging is done using a special "Super-State" mode of the Chips and Technologies F8680 microprocessor in the terminal. Since all software in this device runs in real-mode, most "well-behaved" IBM PC-compatible serial communications programs could be used.

[0333] One solution to reduce the cost of multiple cradle installations is eliminating the microprocessor in all but one (the "master") of the cradles in each "chain" of up to for example 60 cradles.

[0334] In order to meet all of the common requirements for cradles (especially chaining), a method for synchronis-

system provides for one or more of the following configurations as shown in Table 1:

TABLE 1

Configuration Name	Technology Used	Mode Used
Vehicle Cradle	Internal Standard and/or IrDA	Serial Port Emulation
Depot Cradle	Internal Standard	Chainable Cradle
IrDA Peripheral	IrDA	Air Network

[0348] Supporting the combination technologies provides optimal connectivity and flexibility. IrDA provides fairly high bandwidth (115.2 K Baud), line-of-sight, short range (sub-meter), low power communications, plus compatibility with industry-standard IrDA peripherals. The internal standard provides a lower bandwidth (19.2 K Baud), omni-directional, medium range (3-6 meters), higher power communications. By providing a single integrated solution that supports the two technologies and allows them to be used interchangeably, the system should maximize the potential for wireless connectivity.

[0349] Fig. 44 shows an IrDA "air" network allowing IrDA wireless communication between a terminal 7180 and each of an IrDA equipped server 7182 and an IrDA compatible printer 7184, IrDA communication between IrDA equipped lap-top or other portable computer 7186 and each of the server 7182 and printer 7184, as well as IrDA communication between the terminal 7180 and the lap-top 7186. In Fig. 45 serial port emulation is shown for IrDA and/or internal standard technology. A terminal 180 communicates with a cradle 7188 by IrLAP, IrLMP, TinyTP and IrCOMM and either of IrDA or the internal standard technology. Where IrDA technology is used the cradle 7188 communicates with a host/server gate way 190 via a RS-232 C interface. Where the system uses the internal standard technology the cradle 7188 communicates with a printer 7192 via a RS 232C interface.

[0350] The IrDA and/or internal standard technology chained cradle shown in Fig. 46 includes communication between a plurality of terminals 7180 and respective cradles 7188 communicating by either of IrDA or internal standard technologies together with IrLAP, IrLMP, TinyTP and IrCOMM. The cradles communicate with each other via a cradle bus and a master cradle communicates with a host/server 7190 via an RS 232C interface.

[0351] In the in-terminal hardware design with IrDA and internal standard shown in Fig. 47 a CPU 7194 communicates with a multiplexer 7196 directly and via a UART 7198. The multiplexer 7196 communicates via IrDA drivers 7200 with the IrDA optics 7202 and via an internal standard specific unit 7204 with an antenna 7206. The terminal as a whole is designated 208.

[0352] Referring to Fig. 48, a cradle 7210 incorporates the serial port emulation hardware design with IrDA and the internal standard cooperates with a microprocessor 7212 having RAM memory storage 7214 and ROM memory storage 7216 at its core. The microprocessor 7212 communicates to the host (shown schematically at 7218) via a UART 7220, an RS 232 driver 7222 and an RS 232 connector 7224. The microprocessor 7212 communicates with a multiplexer 7226 directly and via a UART 7228. The multiplexer 7226 communicates with IrDA optics 7230 via IrDA drivers 7232. The multiplexer also communicates with an antenna 7234 via an internal standard unit 7236.

[0353] Referring now to Fig. 49 a chainable cradle design with IrDA and internal standard technologies comprises a microprocessor carrying RAM memory storage 7240 and ROM memory storage 7242. The microprocessor 7238 communicates with an arbitration unit 7244 directly and via a UART 7246. The arbitration unit arbitrates between the communication to the next cradle away from the host and communication to the host or the next cradle towards the host. The arbitration unit 7244 in either case communicates with a dedicated RS 232C connector 7248a,7248b via a dedicated RS 232 driver 7250a,7250b. The microprocessor also communicates with a multiplexer 7252 directly or via a UART 7254. The multiplexer allows communication with an antenna 7256 via an internal standard unit 7258. The multiplexer 7252 also communicates with IrDA optics 7260 via an IrDA driver 7262. The cradle is shown generally at 7264.

[0354] The software data/control flow within the terminal is shown schematically in Fig. 50. The IrD applications 7264 flow via TinyTP, IrLMP, IrLAP 7266; Real UART 7268 and the IrDA optics and drivers or internal standard units in antenna 7270. Legacy applications 7272 flow via emulated UART 7274; IrCOMM 7276 and then follow the same path as the IrDA applications.

[0355] Fig. 51 shows software data in control flow within the cradle. Flow from IrDA to RS 232 bridge 7278 - RS 232C connector 7280 is via UART 7282 and RS 232C drivers 7284. Data flow IrDA to RS 232 bridge 7278 - IrDA drivers and optics/internal standard unit and antenna 7286 is via IrCOMM 7288; TinyTP, IrLMP, IrLAP 7290 and UART 7292.

[0356] Many client devices are configured to receive an adapter card allowing them to perform network access.

[0357] The components of such devices and adapter cards are well known to the skilled person and will not be described in detail here. One example of a network adapter is the system sold under the trade mark SPECTRUM 24 by the assignees of the present application.

Server into the disk it is emulating. The simplest way to do this is to treat each File System mounted via the NFS Client 7374 as a subdirectory in the emulated drive. By limiting the File System names to 8 characters, the name of the File System can also be the name of the subdirectory (off the root of the emulated ATA drive) that is used to access that File System.

[0371] When accesses are made to the sectors containing the directory information for a File System, the ATA 7396 controller must obtain the current directory information from the File System via the corresponding NFS Client 7374, construct the directory sectors accordingly, and make them available to the Client Device (via the ATA interface 7378). When accesses are made to the data sectors referenced by the directory sectors, the ATA Controller 7396 must obtain the data for the accessed files via the NFS Client 7374, create the data sectors, and make them available to the Client Device.

[0372] If the File Access Card 7370 has sufficient Flash memory 7386, it may make sense to cache sectors of directory or data so that frequent accesses by the Client Device execute faster. This must be balanced carefully to trade off quick access with accurate data. Since the files on the mounted File system may be accessible by other Clients, they are not guaranteed to remain valid once they have been cached in the File Access Card 7370. Adjustments to allow the Client Device to control the behaviour of the caching logic would be necessary. This information can be stored in a configuration file along with the other parameterization information.

[0373] Security issues may arise due to the need to store log on names, passwords, etc. within the Flash memory 7386 of the File Access Card 7370. As this information now travels with the card and, being portable, may represent a security breach, it is possible to use various encryption techniques to secure the configuration files from unauthorized browsing. The File Access Card 7370 needs to make a temporary, unencrypted copy of this file for the use of the Protocol Stack(s) 7372 and NFS Client(s) 7374 whilst it is starting up. Once it is running, this temporary copy can be removed. So long as this temporary copy is not accessible to the Client Device it does not represent a security breach.

[0374] Data integrity issues may arise due to the need to power cycle the File Access Card 7370 when used in portable Client Devices. Additionally, any time the card is removed from the Client Device, it loses power. The design of the ATA controller 7396 must ensure that a write is completed fully or not at all. This is a standard design constraint of Flash memory-based ATA controllers. The File Access Card 7370 must take this precaution one step further. A write cannot be considered complete until it has been successfully propagated to the File Server. Any local caching performed within the File Access Card 7370 must synchronize with this all-or-nothing write behaviour.

[0375] The File Access Card 7370 must establish/reestablish connections and mount/remount File Systems automatically whenever power is applied to the card. This may take a significant length of time and access to the card may need to be delayed until this processing is complete. This is already possible with ATA cards, where the time needed to "spin up" a hard disk may be significant. The ATA/IDE 7378 interface provides the mechanism necessary to delay access to the card until it is ready. Furthermore, when accesses to card data require NFS activity to get the data, individual accesses may be quite slow. The same mechanisms described previously can be applied to hold off the Client Device until data is available.

[0376] Since the File Access Card 7370 must contain essentially the same hardware and firmware as a standard Adapter Card, it could also be designed to operate as such an Adapter Card. This would, of course, require the Adapter Card Driver and Protocol Stacks to be present in the Client Device. This would allow the card to be used as either a File Access Card or a standard Adapter Card interchangeably (although not at the same time).

[0377] It is also possible to create a custom communication layer between the Client Device and the File Access Card 7370 that replaces the standard network layers that would normally be present on the Client Device. Since the File Access Card 7370 contains the ODI driver 7390 and Protocol Stack(s) 7372, there is no need to duplicate these components in the Client Device. The application interface to the network can be reimplemented to use this custom communication layer, instead of talking directly to the Protocol Stack(s) 7372. The end result is that Client Device applications can utilize network services without actual Protocol Stacks 7372 executing on the Client Device. Suitable application interfaces will be well known to the skilled person and are not described further here. For example the interfaces available under the trade marks BERKELEY SOCKETS or WINSOCK would be appropriate.

[0378] Using the above approach it is then possible to permit direct access to network services (e.g. via application interfaces) concurrently with access to File Server files. This would require, of course, that the File Access Card 7370 possessed sufficient computing capabilities to support emulation of the ATA/IDE interface 7378 and support the custom communications layer at the same time.

[0379] The above described arrangement gives rise to a number of advantages in applications. For example the invention provides support for wireless access to files on file servers from any Client Device such as a PCMCIA slot and supports access to ATA cards. Client Device specific protocol stacks or NFS Clients are not required. At the same time simplified configuration for access to NFS File System is allowed. Once a card has been configured for use with a given set of protocol stacks, NFS Clients and File systems it can be freely moved from Client Device to Client Device with no change in configuration required. Because no protocol stacks or NFS Clients need to be present on the Client Device reduced memory and secondary storage requirements for Client Devices are achieved, allowing yet thinner clients. The

- Control signals, for example clock, data transfers, valid address, valid data, zero wait state for current bus cycle, oscillar clock signal, reset-return to default state and prepare for normal XIP and Disk operations. If necessary, the Device can drive this line to keep the system in reset state until its own reset is complete, I/O device read strobe command, I/O device write strobe command, memory read strobe command, memory write strobe command signal to the system that the current I/O or EPROM memory cycle must be extended. This signal must be used in accordance with the performance requirements described below, signal to the System that a 16 bit EPROM memory cycle is required. This signal must not be used by the Device unless the USEMEM 16 signal is present indicating that the System is capable of and willing to participate in 16 bit EPROM memory cycles. Indicate to the System that a 16 bit I/O cycle is required. This signal must not be used by the Device unless the USEIO16 signal is present indicating that the System is capable of and willing to participate in 16 bit I/O cycles.

- EPROM Control Signals for example:

  Indicate that the System is accessing the XIP section of the Device. This signal is generated by address decoding logic in the System and is presented after the appropriate address lines are valid. Indicate to the System that the XIP section access is complete and that the XIP section data is available on the data lines. If this does not occur within a single cycle, the Device must use the IOCHRDY signal to initiate extended wait cycles.
  Indicate to the System that the XIP section is ready for access by the System. This signal shall be activated after the initialization process instituted by the RESET signal is completed. The System shall not access the XIP section following RESET until this signal is activated by the Device.
  Indicate that the System grants permission to the Device to update the contents of the IPL subsection of the XIP section. When this signal is not present, the IPL subsection contents must not be modified (even if the appropriate commands are sent to the Device by the System).

- Device Option Control Signals including:

  Indicate that the system wishes the Device to enter its lowest power state as soon as possible. Power consumption and timing requirements are described below. Once in suspend state, the Device need not support XIP or Disk accesses until this signal is deactivated and the Device has resumed operation (indicated by deactivating the SUSPSTATE signal).
  Indicate to the System the current suspend state of the Device. If the Device is currently in suspend state, this signal will be active, otherwise it will be inactive.
  Indicate that the System grants permission to the Device to use full power at will. Full power operations performed at the discretion of the Device (e.g. background operations), are only allowed when this signal is active. Full power is always permitted to be used by the Device during an explicitly requested XIP update or Disk write operation, regardless of the state of this signal.
  Indicate to the System that the Device is currently using full power. This signal need only be set when the previous signal indicates that the Device is permitted to use full power in the background and when the Device is actually doing so. This signal may also, but is not required to, be used to signal use of full power during an explicitly requested XIP update or Disk write operation.
  Chip select signal for IDE to addressee.
  Drive Active/Salve Present signal used by a Slave IDE device to acknowledge the Master IDE device during initialization. Signal used by the System or the external configuration fixture to indicate that the Device may be reconfigured and that the 5 and 12 volt supplies are available. The configuration of the Device shall not be changed (even if the appropriate commands are sent to the Device by the System) unless this signal is present.
  Indicate that the System is capable of executing 16 bit I/O cycles and is willing to interact with the Device using such cycles. The Device decides whether to use 8 and 16 bit cycles and indicates the choice to the System via the appropriate signal.
  Indicate that the System is capable of executing 16 bit EPROM memory cycles and is willing to interact with the Device using such cycles. The Device decides whether to use 8 and 16 bit cycles and indicates the choice to the System via the MEMCS16 signal.

- Address Signals, for example

  To address the [up to 256K of the] XIP section of the Device, the System.
  If an implementation of the Device chooses to expand the size of the XIP section beyond 256 KB, additional address bits may be used to address the extra memory. The Device can assume that ALL address bits are valid

TABLE 2 (continued)

State Name	Enter Lowest Power State Signal	Current Suspend State Signal	Full Power at Nil Signal	Device using Full Power Signal	Maximum Permitted Current Load
Background Busy	inactive	inactive	active A high power background operation is in progress.	active	50mA
Normal Idle	inactive	inactive	inactive No explicitly requested XIP update or Disk write operation is in progress.	inactive (within 1ms)	20 mA
Normal Busy	inactive	inactive	inactive No explicitly requested XIP update or Disk write operation is in progress.	inactive (within 1ms)	50 mA

[0394] If the Device supports an IDE formatted section, then is shall support the standard Idle and Sleep commands of the ATA specification for controlling the power states of the IDE Disk controller.

[0395] Since the Device is intended for embedded applications and especially mobile embedded applications, size is of significant concern. A system design incorporating the Device must balance capacity vs. available space. For example several discrete sizes will be standardized in each of the two embodiments (Modular and Component).

[0396] The functional requirements of the Device are as follows:

[0397] Referring to Fig. 52, a block diagram showing the logical structure of a typical implementation of the Device, the Device 7300 provides support for two storage sections: An XIP (eXecute In Place) section 7302 and a Disk section 7304.

[0398] The XIP section of the Device 7304 supports adjustment in size ranging from OKB up to 256KB in 64KB increments.

[0399] Larger XIP sections (greater than 256KB) and/or smaller adjustment granularities (less than 64KB) may optionally be supported, but must not prevent compatibility with the above requirements.

[0400] The Device contains two logical controllers 7306a,7306b and two logical storage areas 7308a,7308b. Although specific implementations of the Device might combine the functions of the two controllers or storage areas, these terms are used herein to describe the required functionality.

[0401] The XIP section 7302 of the Device 7300 is subdividable into 2 subsections: the IPL (Initial Program Loader) subsection and the BIOS (Basic Input/Output System) subsection. For use in a specific System each Device is configured for the use of the required subsection(s).

[0402] The IPL subsection of the XIP section of the Device, if configured for use by the System, is 64KB in size and is addressed as the first 64KB of the linear addressable area of the XIP section. If the design of a System requires the IPL subsection to be interchanged with the BIOS subsection, then the System must provide the logic to adjust the address lines supplied to the Device. No XIP section remapping logic is required to be implemented within the Device.

[0403] IPL subsection sizes larger or smaller than 64KB may optionally be supported, but must not prevent compatibility with the above requirements.

[0404] The BIOS subsection of the XIP section of the Device, if configured for use by the System is adjustable in size ranging from 64KB to 256KB in increments of 64KB. A BIOS size of 256KB is allowed by a Device with a 256KB XIP section only if the IPL subsection is not configured for use. If the design of a system requires remapping of areas of the BIOS, then the System must provide the logic to adjust the address lines supplied to the Device. No XLP section remapping logic is required to be implemented with the Device.

[0405] Larger BIOS subsection sizes and/or smaller granularities may optionally be supported, but must not prevent compatibility with the above requirements.

[0406] For Modular embodiments of the Device, the partitioning of the Device into the XIP section and the Disk section is possible via a separate external configuration fixture to which the Device is connected via the standard connector described above.

[0407] For Component embodiments of the Device the partitioning of the Device into the XIP section and the Disk section is possible either in-circuit or via an external configuration fixture (if the System board itself is equipped with the standard Device connector).

protectable from update via a signal hat "protects" or "unprotects" the IPL subsection.

[0425] The Disk section shall be updatable, in circuit, via the standard DOS disk driver and the standard BIOS IDE or FTL drivers, regardless of the specific technologies used in the implementation of the Disk storage area of the Device.

[0426] The rated storage capacity of the Device is defined to be the size of the Disk section supported by the Device when an XIP section of 256KB has been configured. This should provide a worst case measurement for all implementations.

[0427] Although it is permissible for an implementation to extend the size of the XIP area beyond the requirements of this specification, this extra space shall not be considered to increase the rated storage capacity of the Device unless incorporated into the Disk section when the XIP section is configured to a size to 256KB.

[0428] The XIP section of the Device provides performance sufficient to allow direct execution of code from the emulated linear memory. Since the Device is interfaced through the ISA bus, the maximum speed of access may be limited where appropriate by the 8MHz ISA bus speed. Use of ISA bus extended wait states (through the use of the appropriate signal) is permitted in the event of delayed access to XIP data, but the maximum number of wait states shall be no more than 10 and the average number of wait states shall be no more than 2.

[0429] Although the System may optionally support the ability to "Shadow" the BIOS or other system code from the XIP area into system RAM for improved performance, this must not be required to meet the performance requirements above.

[0430] The programming requirements of the Device are as follows.

[0431] A special I/O interface is provided by the XIP controller within the Device for determining the capabilities of the Device. This includes, but is not limited to, the following information:

- Granularity of adjustment of XIP section (granule size)

  Specified as an integral number of KB

- Maximum size of XIP section

  Specified as an integral number of granules
  Must be greater than or equal to 256KB

- IDE format disk section presence flag
- FTL format disk section presence flag
- Size of FTL erase blocks (if FLT format is used)

  Specified as an integral number of granules

The Device is not required to permit read accesses to the XIP section interleaved with accessed to the I/O interface of the XIP controller. As a result, the System may not execute from the XIP section while updating or configuring the XIP section via the XIP controller.

[0432] A special interface is provided by the XIP controller within the Device for determining the current configuration of the Device. This includes, but is not limited to, the following information:

- Current IPL subsection size

  Specified as an integral number of granules

- Current BIOS subsection size

  Specified as an integral number of granules

- Choice of IDE or FTL formatted drive as the "boot" device

  When both are present

[0433] The Device is not required to permit read accesses to the XIP section interleaved with access to the I/O interface of the XIP controller. As a result, the System may not execute from the XIP section while updating or configuring the XIP section via the XIP controller.

174 - host applications
200 - registration
202 - decapsulate
204 - source MAC
206 - destination MAC
208 - broadcast
210 - destination MAC
212 - forward
214 - home AP
216 - create entry
218 - encapsulate
220 - encapsulate
222 - forward
224 - forward
226 - send

Claims

1. A portable, hand-held terminal comprising a display, a keyboard and wireless communication means for communicating with a desired destination via one or more access points to a wireless LAN, the terminal further comprising cellular telephone means for continuing communication with the desired destination via wireless telephone communication when the device is out of the range of the access points to the LAN.

2. A device as claimed in claim 1 arranged to communicate via the LAN as a preferred default option.

3. A terminal as claimed in claim 1 comprising an Internet browser, wherein the desired destination comprises an Internet site.

4. A data communication system including a portable, hand-held user terminal comprising a display, a keyboard and wireless communication means, and a wireless LAN having one or more access points, the terminal being arranged to communicate with a desired destination by said wireless communication means via one or more access points to the LAN and further comprising cellular telephone means for continuing communication with the desired destination via wireless telephone communication when the device is out of range of the access points to the LAN.

5. A system as claimed in claim 4 in which the terminal is arranged to communicate via the LAN as a preferred default option.

6. A system as claimed in claim 4 in which the terminal comprises an Internet browser and the desired destination comprises an Internet site.

7. A method of communicating between a portable, hand-held user terminal comprising a display, a keyboard and wireless communication means and a LAN having one or more access points, in which the terminal communicates by said wireless communication means with a desired destination via the access points when in range and continues to communicate with the desired destination via a cellular telephone means using wireless telephone communication when the terminal is out of range of the access points.

8. A method as claimed in claim 7 in which the terminal communicates via the LAN as a preferred default option.

9. A method as claimed in claim 8 in which the terminal is used for at least one of :-

broadcast of data acquired at the terminal;
display at the user device of data acquired from the LAN;
product information retrieval.

10. A method as claimed in claim 8 in which the terminal is used for Internet browsing of an Internet site at the desired destination.

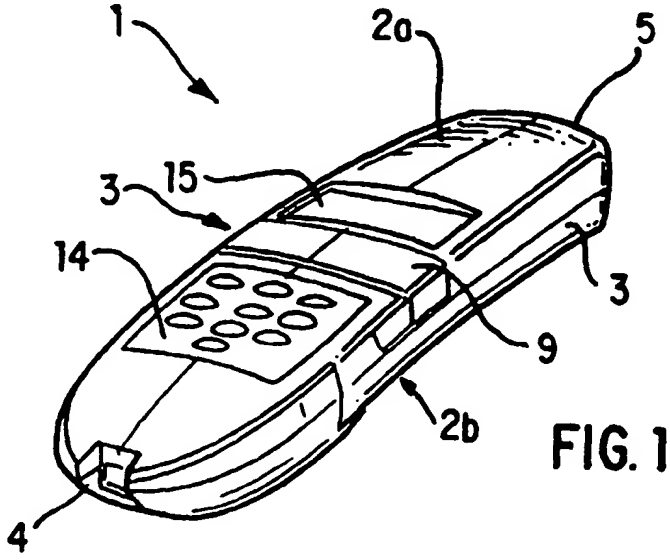

FIG. 1

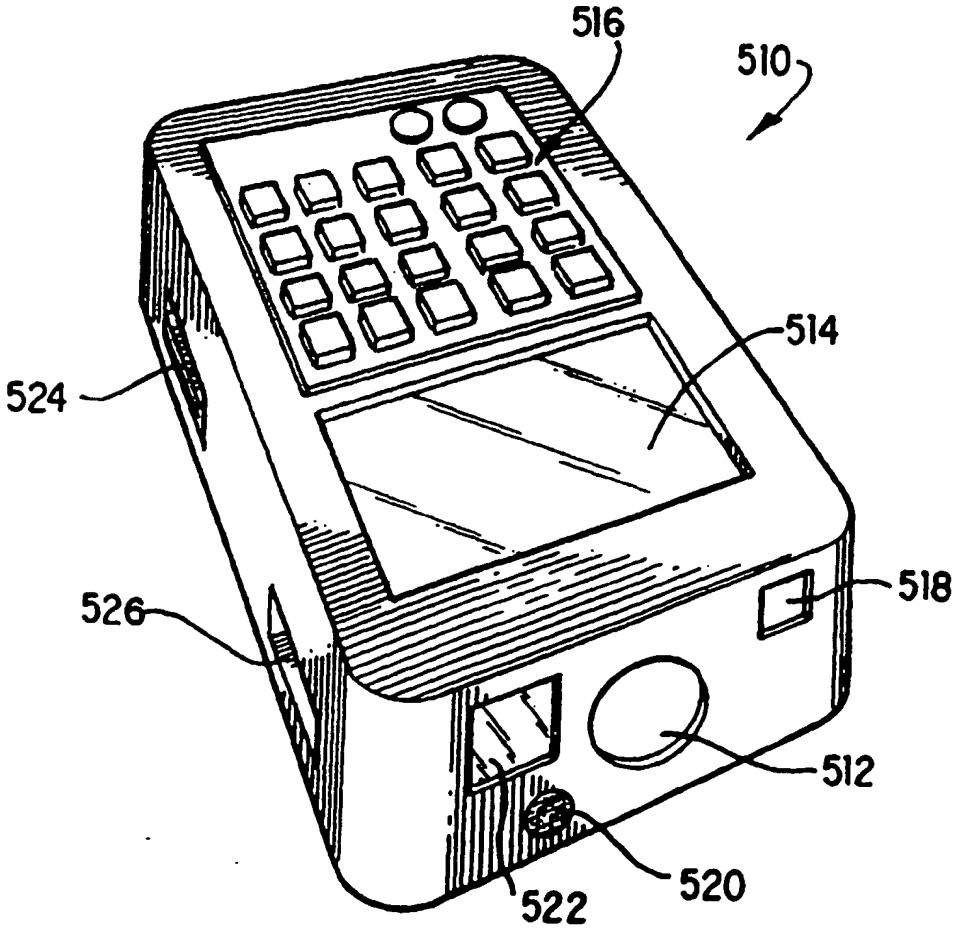

FIG. 3a

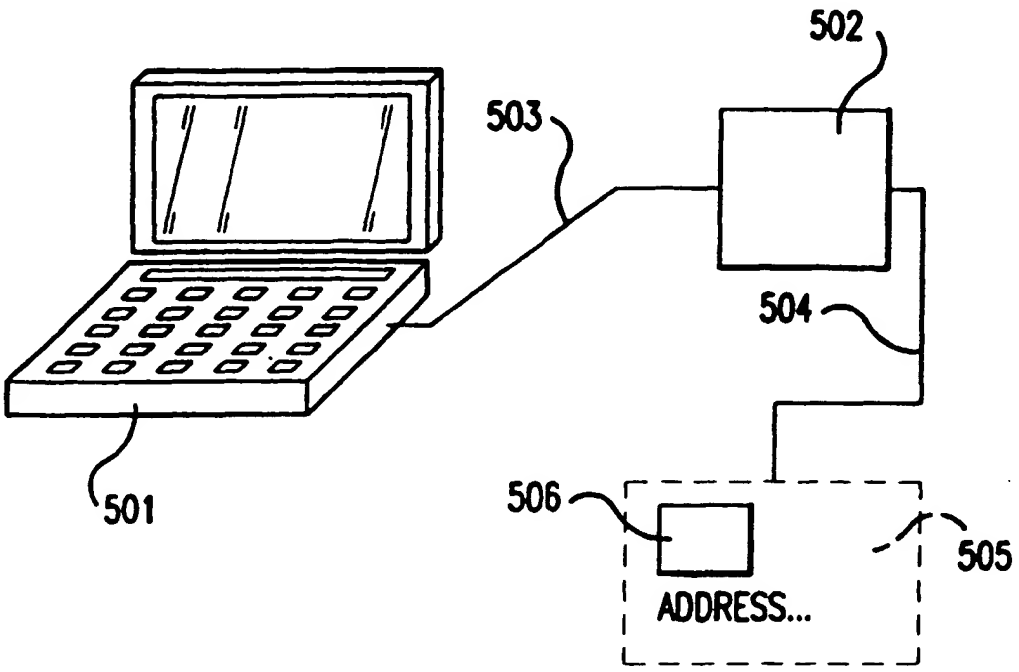

FIG.2a

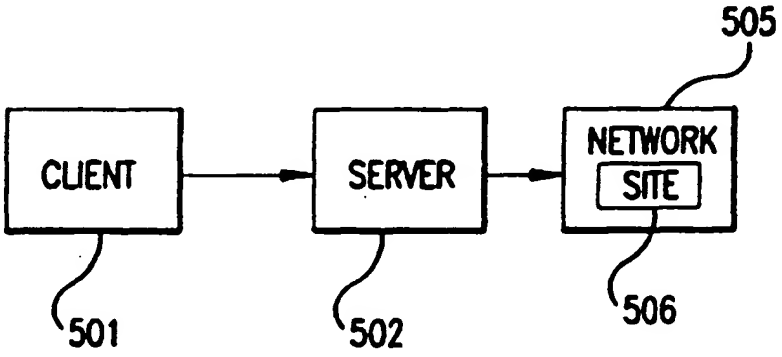

FIG.2b

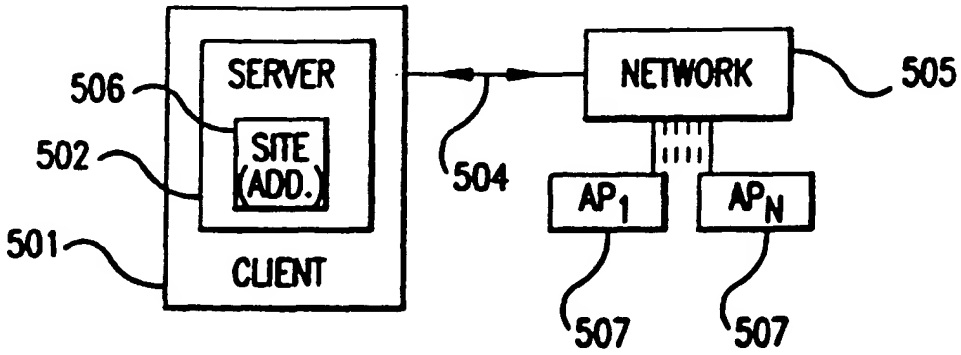

FIG.2c

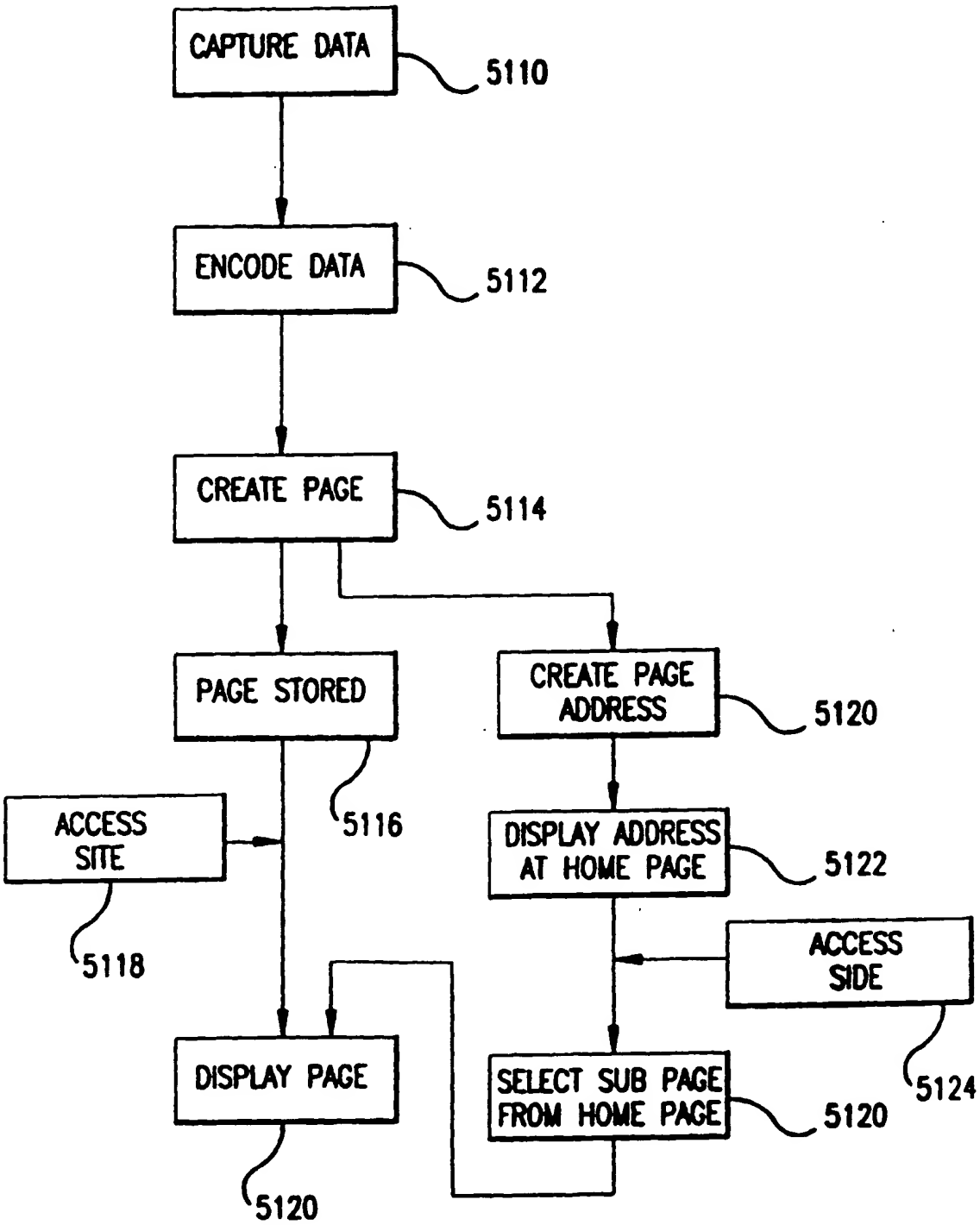
CAPTURE DATA
5110
ENCODE DATA
5112
CREATE PAGE
5114
PAGE STORED
5116
CREATE PAGE ADDRESS
5120
ACCESS SITE
5118
DISPLAY ADDRESS AT HOME PAGE
5122
ACCESS SIDE
5124
DISPLAY PAGE
5120
SELECT SUB PAGE FROM HOME PAGE
5120

FIG.2d

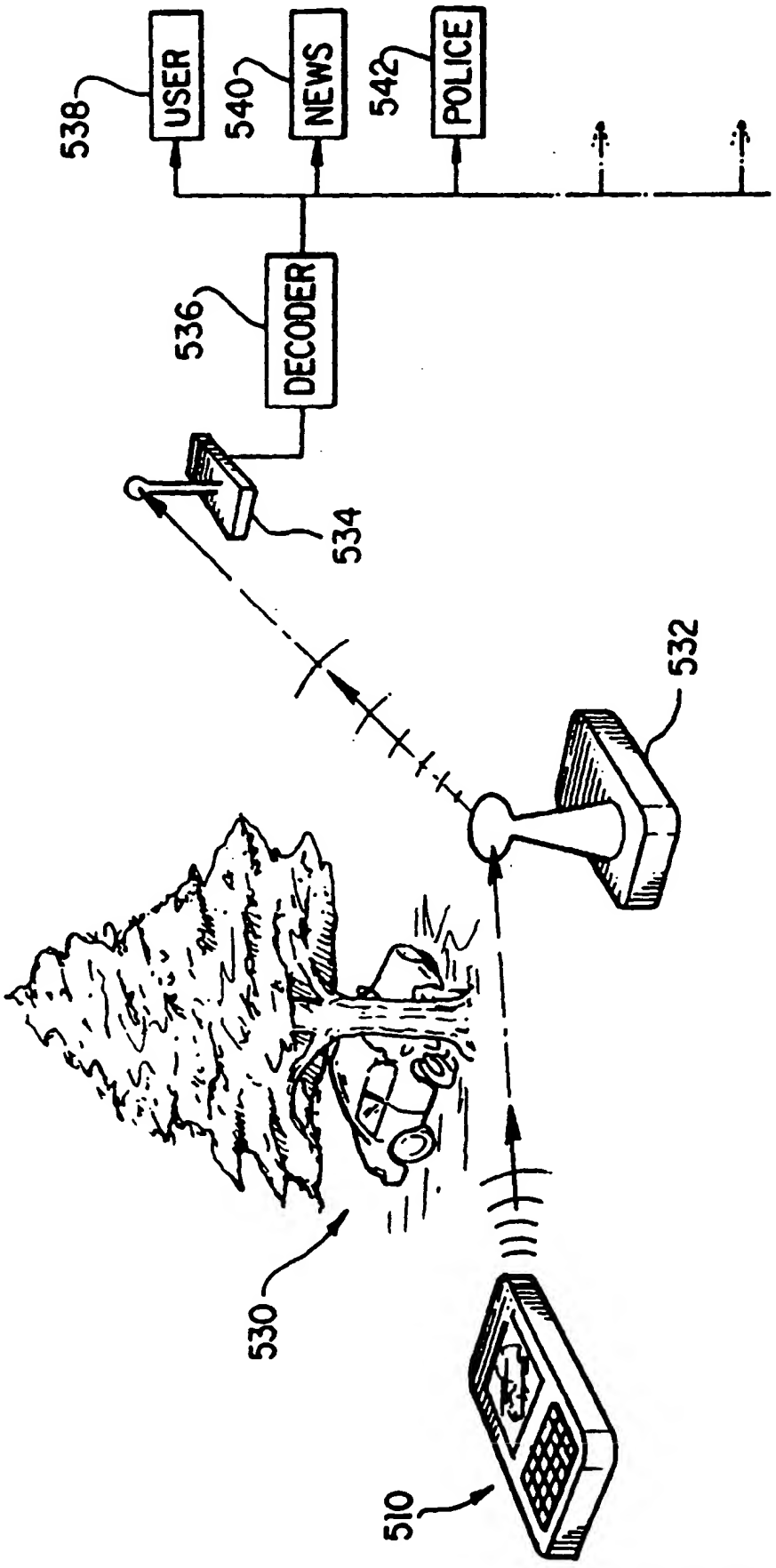

FIG. 3b

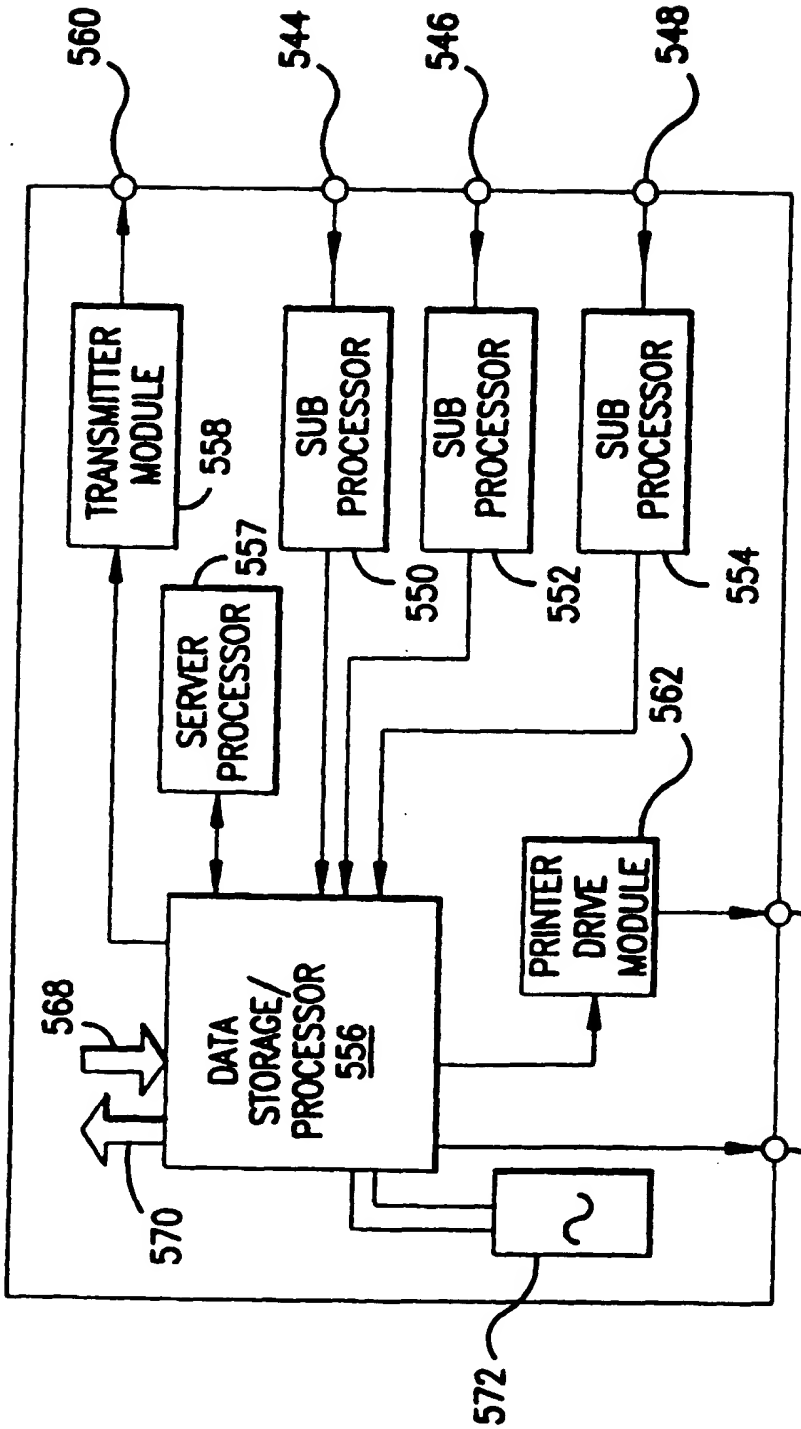
510
560
544
546
548
TRANSMITTER MODULE
558
SUB PROCESSOR
SUB PROCESSOR
SUB PROCESSOR
557
SERVER PROCESSOR
550
552
554
562
PRINTER DRIVE MODULE
564
568
DATA STORAGE/ PROCESSOR 556
566
570
572

FIG.4

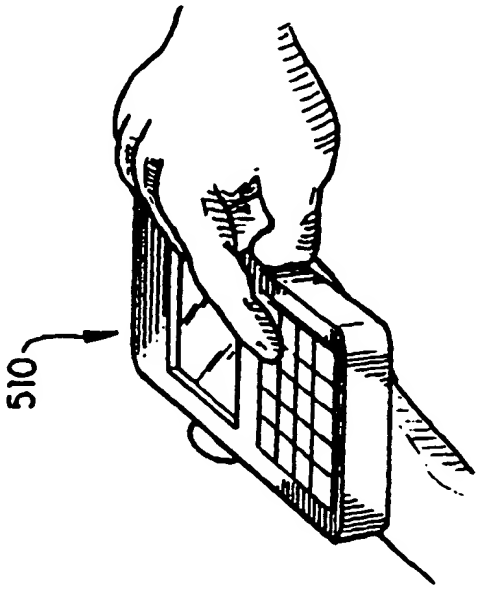

FIG.6

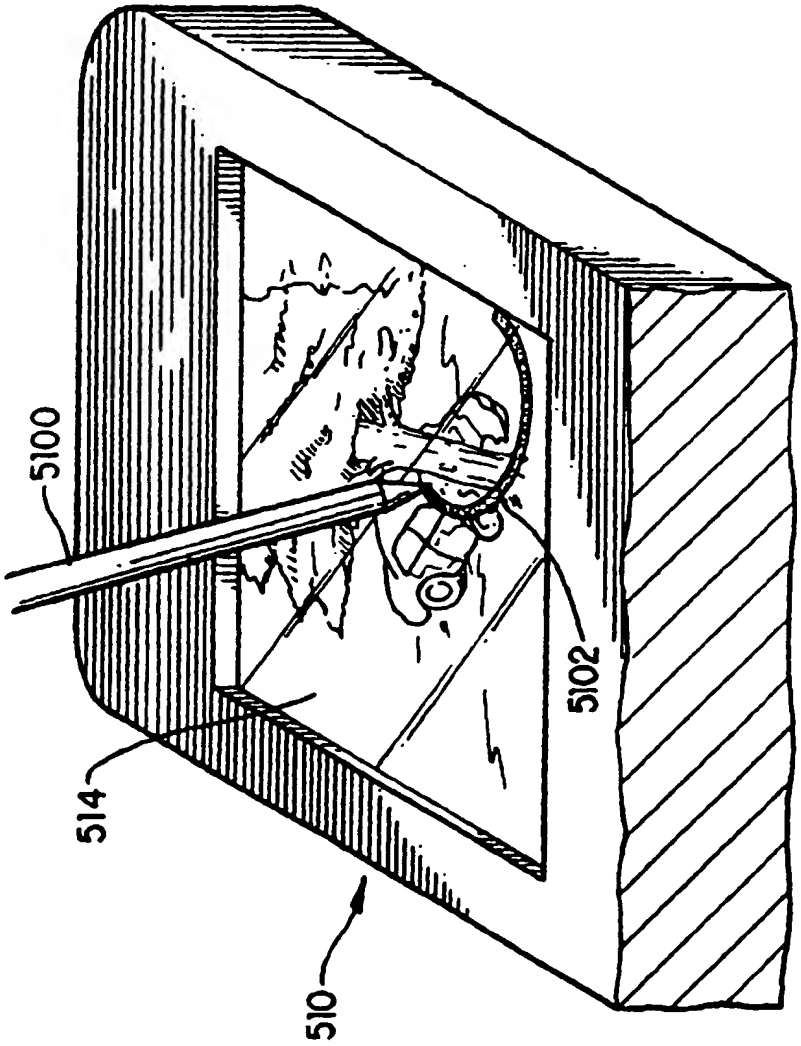

FIG.5

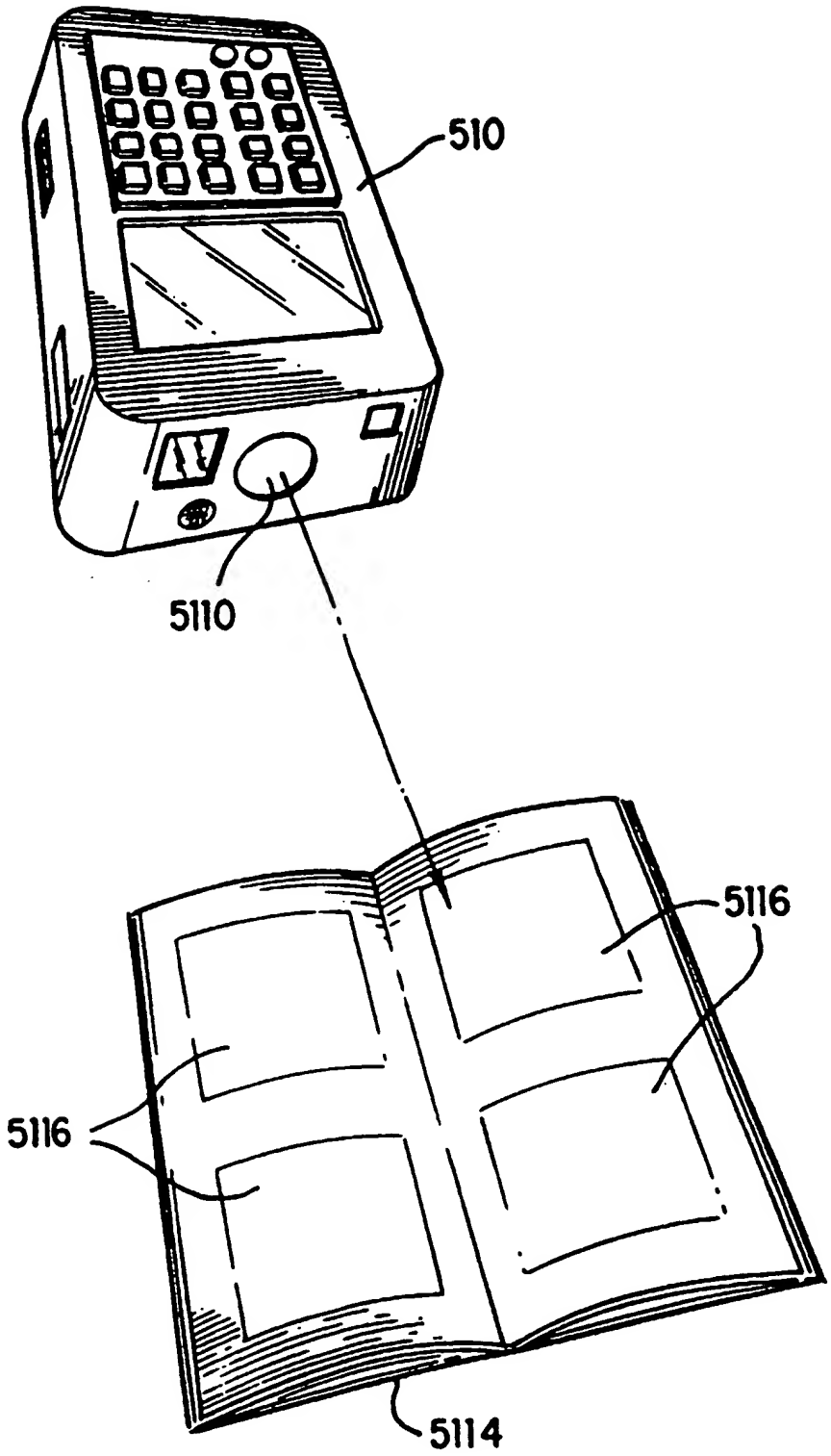

FIG. 7

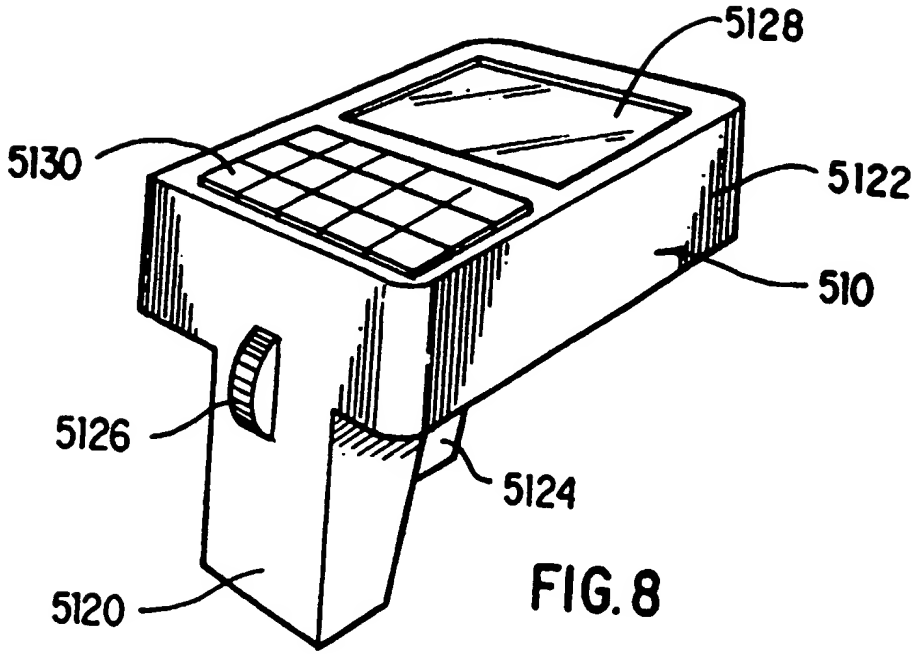
5128
5130
5122
510
5126
5124
5120

FIG.8

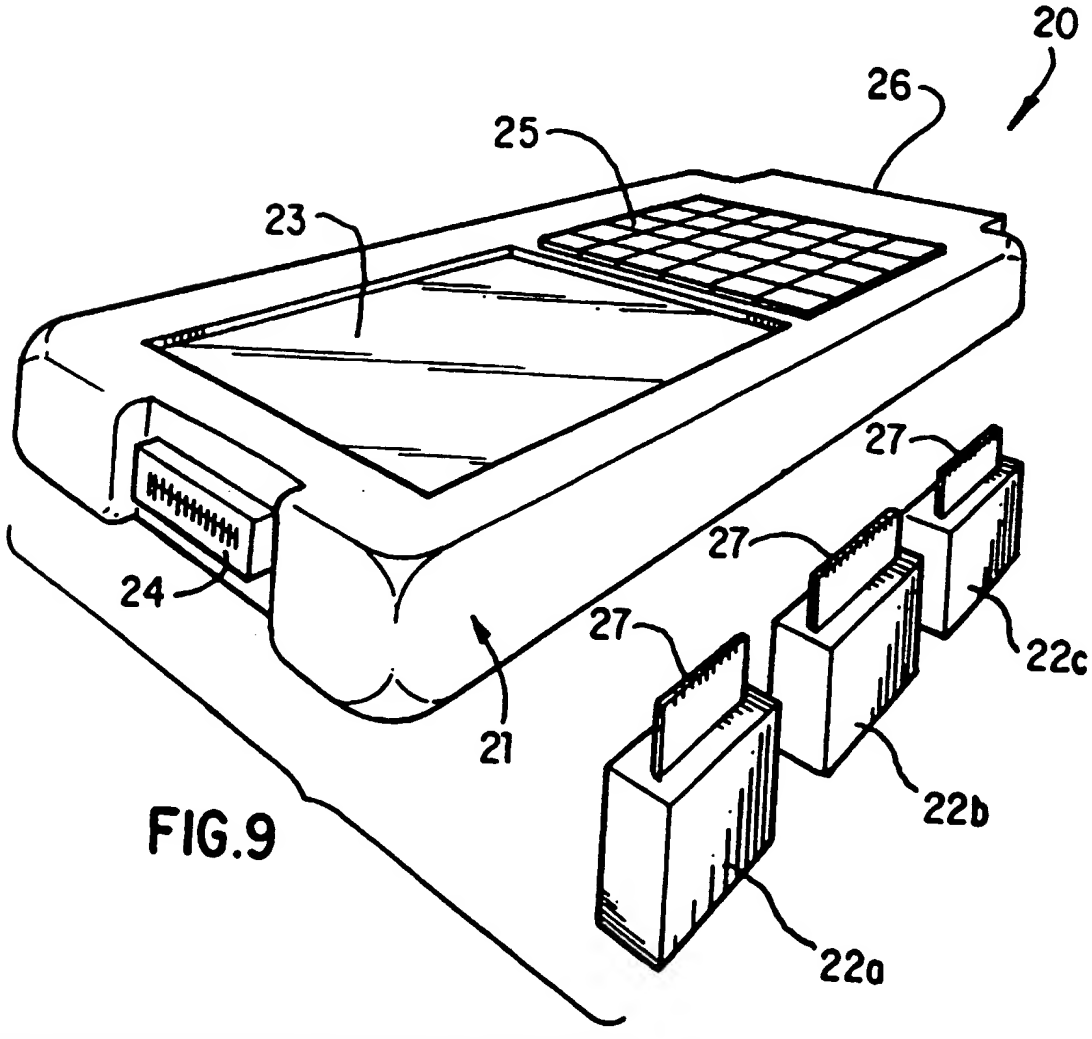
20
26
25
23
27
27
27
24
22c
21
22b
22a

FIG.9

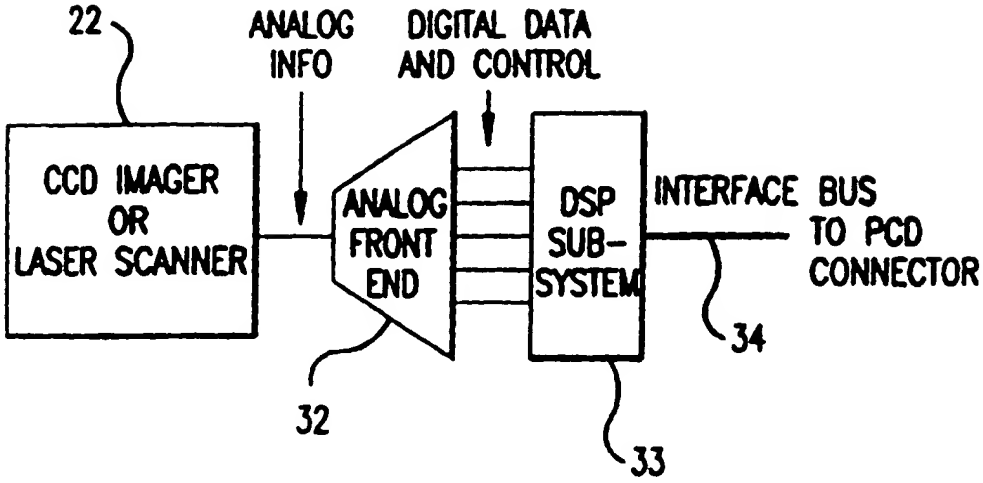
22
ANALOG INFO
DIGITAL DATA AND CONTROL
CCD IMAGER OR LASER SCANNER
ANALOG FRONT END
DSP SUB-SYSTEM
INTERFACE BUS TO PCD CONNECTOR
34
32
33

FIG.10

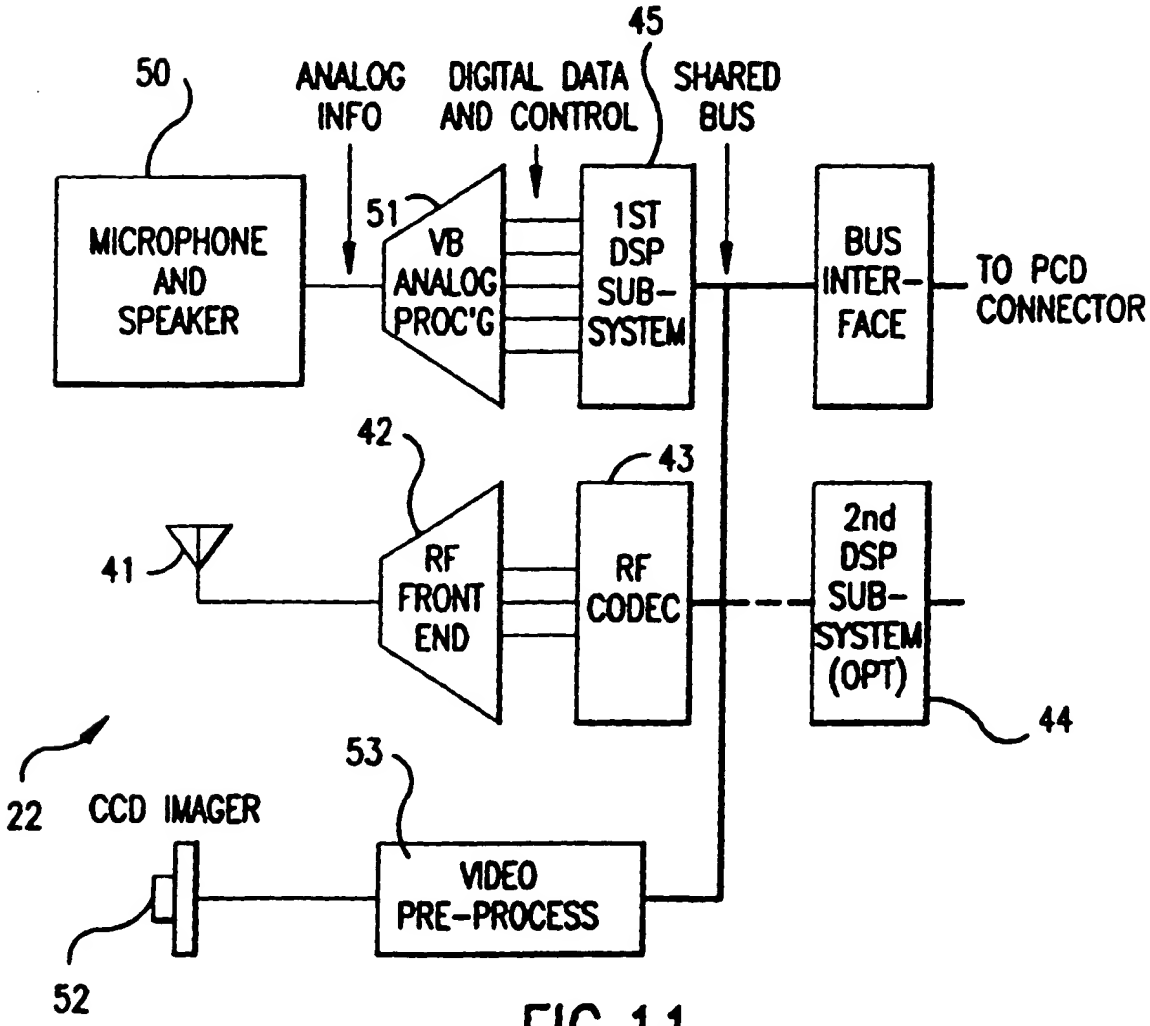
45
50
ANALOG INFO
DIGITAL DATA AND CONTROL
SHARED BUS
MICROPHONE AND SPEAKER
51
VB ANALOG PROC'G
1ST DSP SUB-SYSTEM
BUS INTER-FACE
TO PCD CONNECTOR
42
43
41
RF FRONT END
RF CODEC
2nd DSP SUB-SYSTEM (OPT)
44
22
CCD IMAGER
53
VIDEO PRE-PROCESS
52

FIG.11

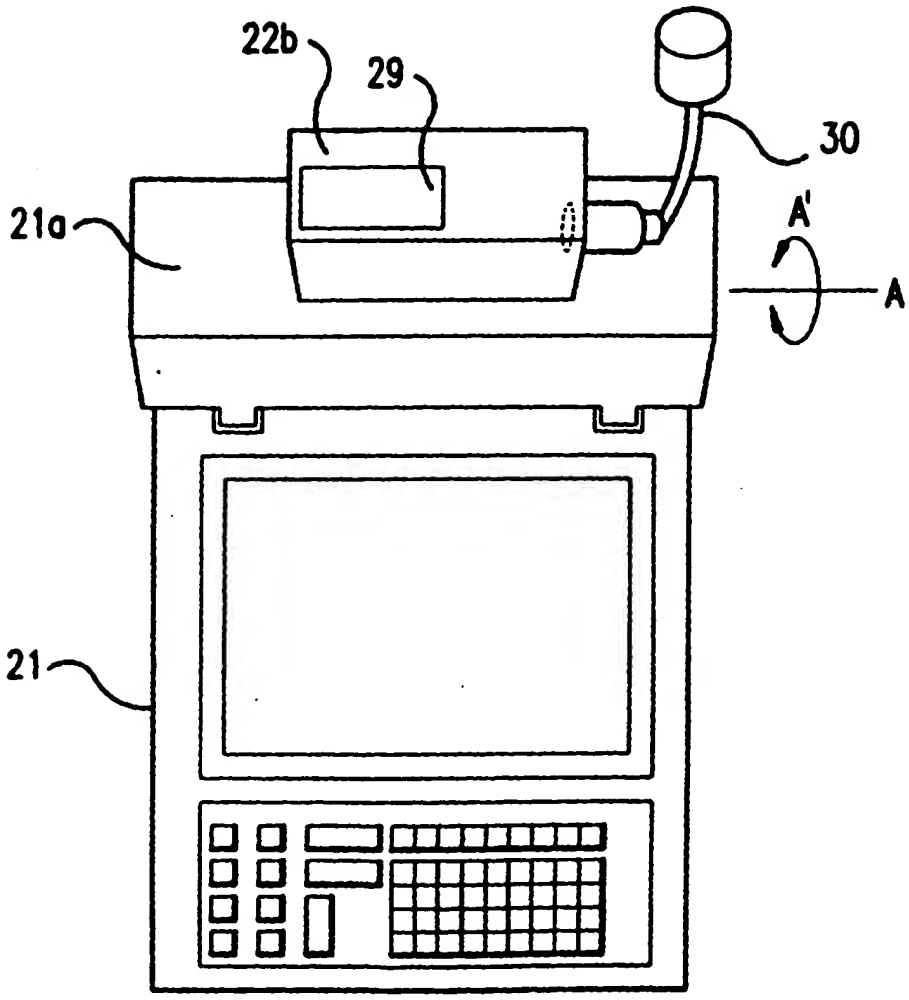

FIG.12

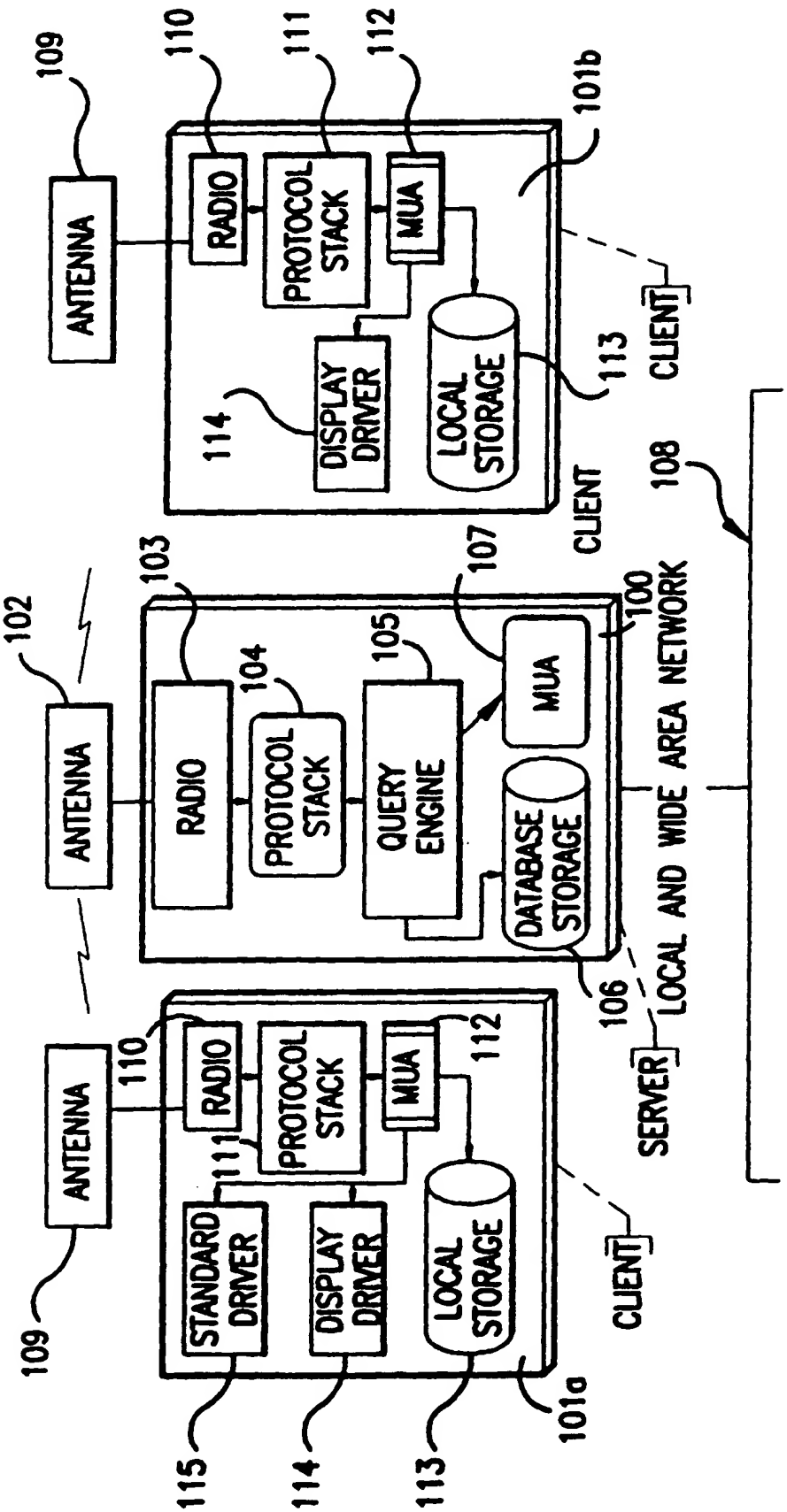
109
110
111
112
ANTENNA
RADIO
PROTOCOL STACK
MUA
101b
114
DISPLAY DRIVER
LOCAL STORAGE
113
CLIENT
CLIENT
108
102
103
107
100
ANTENNA
RADIO
PROTOCOL STACK
104
105
QUERY ENGINE
MUA
DATABASE STORAGE
106
LOCAL AND WIDE AREA NETWORK
SERVER
109
110
ANTENNA
RADIO
111
PROTOCOL STACK
MUA
112
STANDARD DRIVER
DISPLAY DRIVER
LOCAL STORAGE
CLIENT
115
114
113
101a

FIG.13

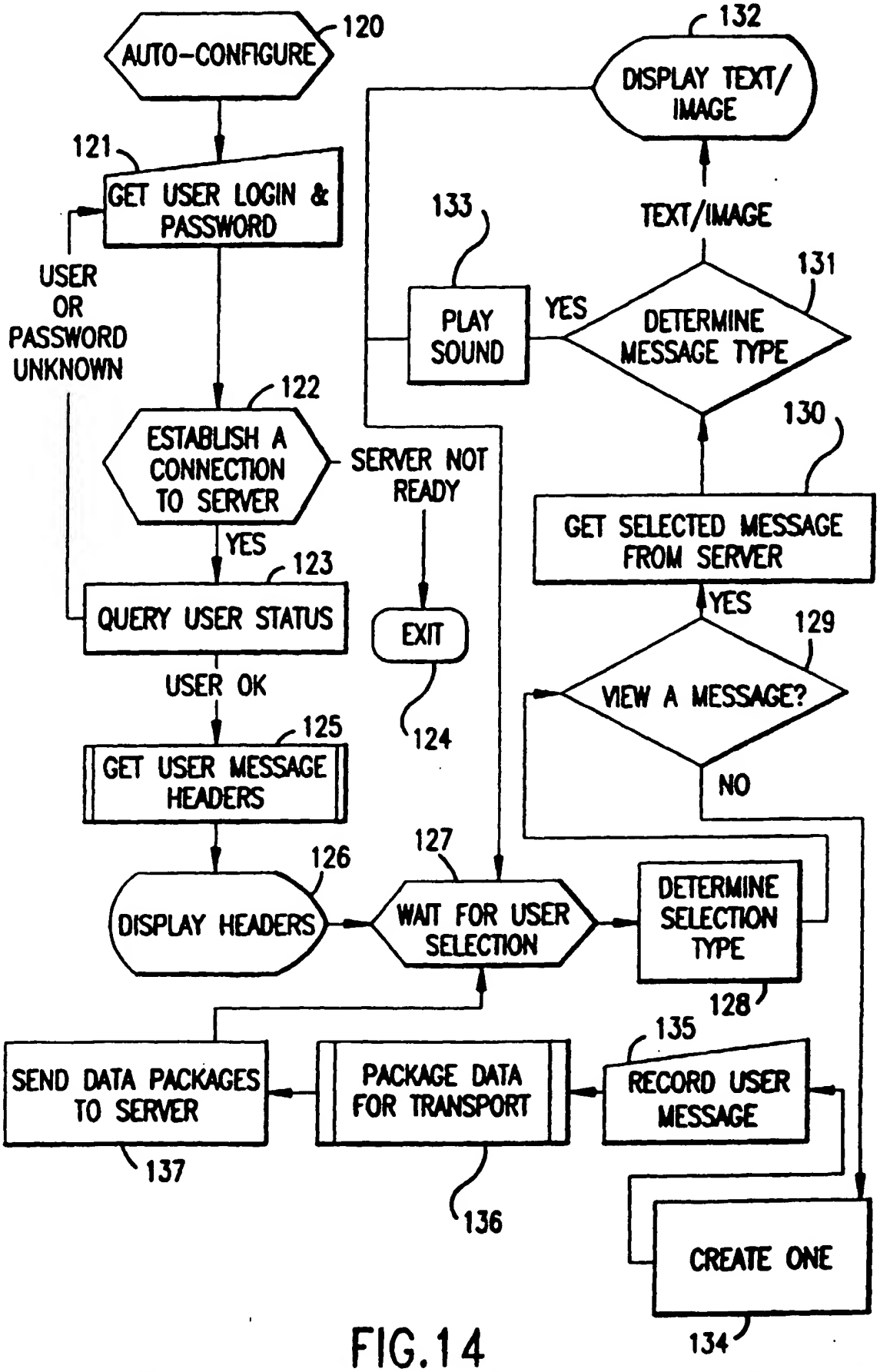
AUTO-CONFIGURE
120
121
GET USER LOGIN & PASSWORD
USER OR PASSWORD UNKNOWN
122
ESTABLISH A CONNECTION TO SERVER
SERVER NOT READY
YES
123
QUERY USER STATUS
USER OK
EXIT
124
125
GET USER MESSAGE HEADERS
126
DISPLAY HEADERS
127
WAIT FOR USER SELECTION
DETERMINE SELECTION TYPE
128
SEND DATA PACKAGES TO SERVER
137
PACKAGE DATA FOR TRANSPORT
136
135
RECORD USER MESSAGE
CREATE ONE
134
132
DISPLAY TEXT/ IMAGE
TEXT/IMAGE
133
PLAY SOUND
YES
131
DETERMINE MESSAGE TYPE
130
GET SELECTED MESSAGE FROM SERVER
YES
129
VIEW A MESSAGE?
NO

FIG.14

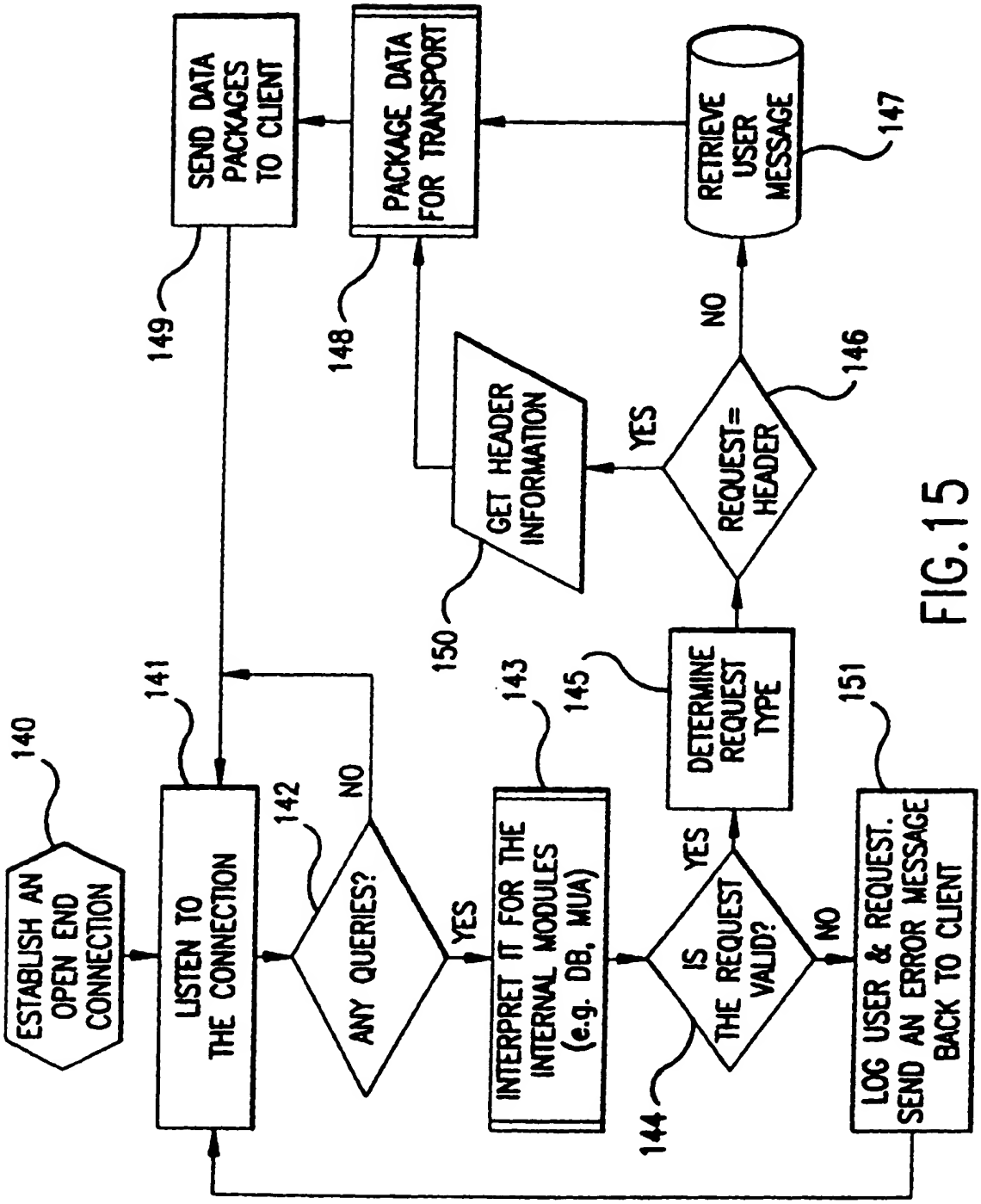
ESTABLISH AN OPEN END CONNECTION
140
LISTEN TO THE CONNECTION
141
ANY QUERIES?
142
NO
YES
INTERPRET IT FOR THE INTERNAL MODULES (e.g. DB, MUA)
143
IS THE REQUEST VALID?
144
YES
NO
DETERMINE REQUEST TYPE
145
REQUEST= HEADER
146
YES
NO
GET HEADER INFORMATION
150
RETRIEVE USER MESSAGE
147
PACKAGE DATA FOR TRANSPORT
148
SEND DATA PACKAGES TO CLIENT
149
LOG USER & REQUEST. SEND AN ERROR MESSAGE BACK TO CLIENT
151

FIG.15

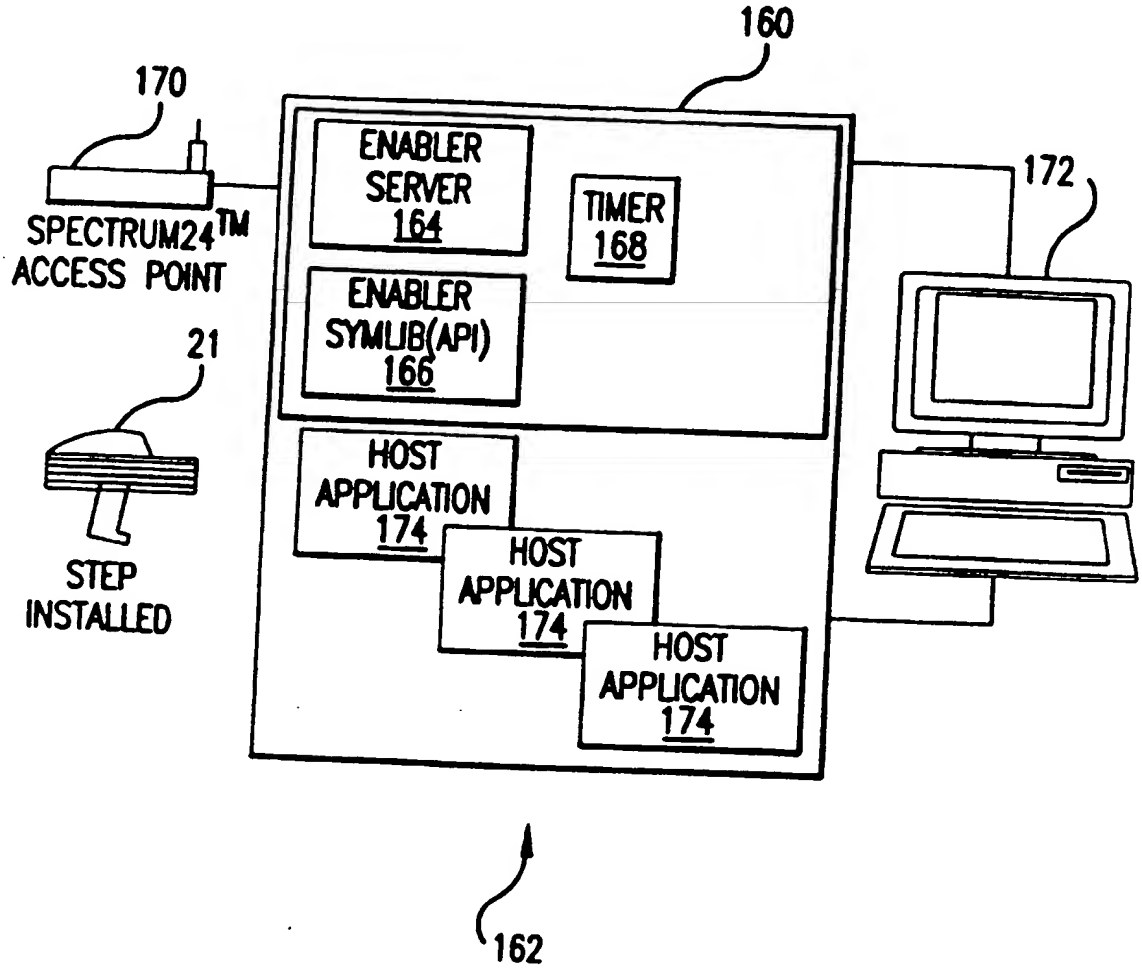
160
170
ENABLER SERVER 164
TIMER 168
172
SPECTRUM24™ ACCESS POINT
ENABLER SYMLIB(API) 166
21
HOST APPLICATION 174
HOST APPLICATION 174
HOST APPLICATION 174
STEP INSTALLED
162

FIG.16

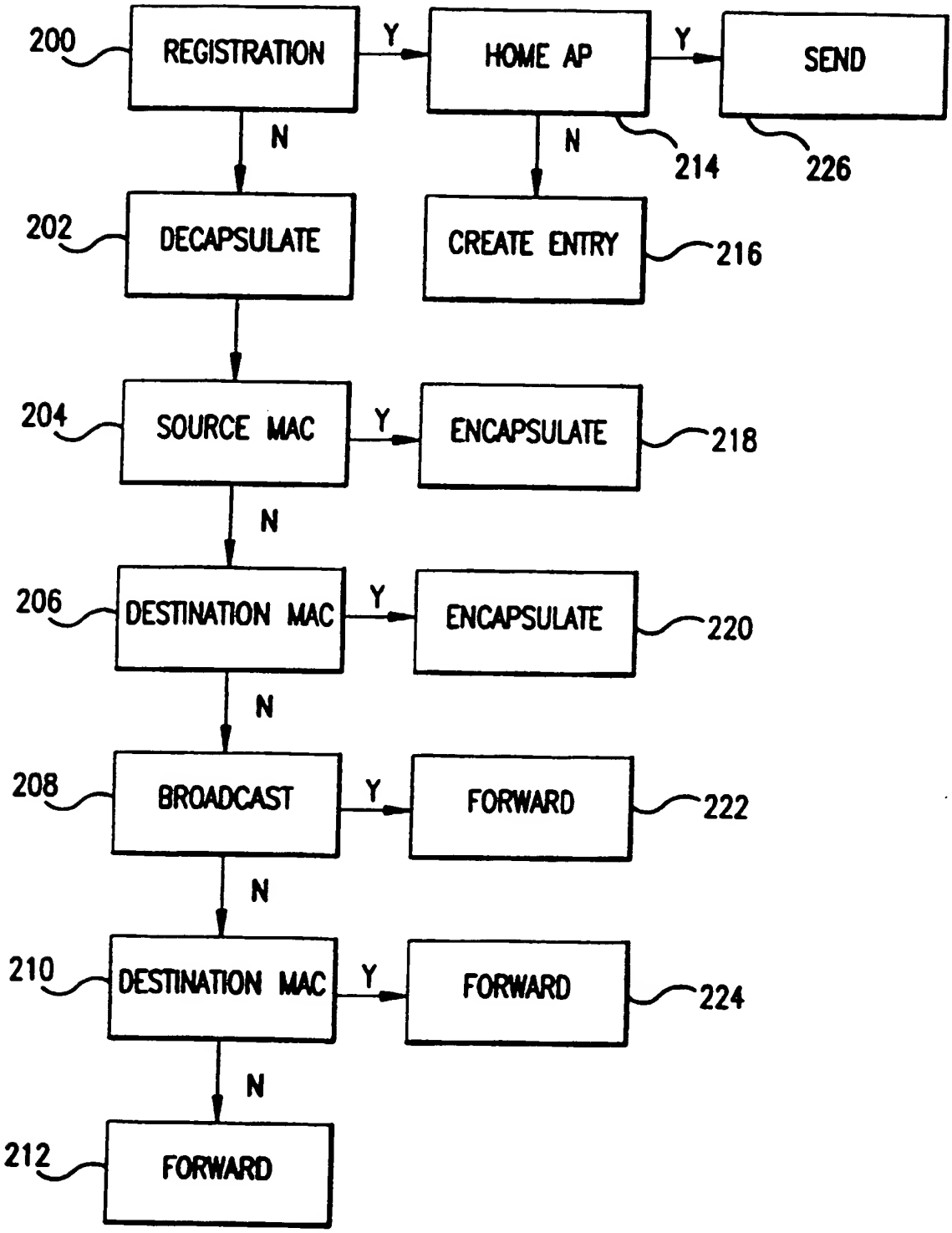
200
REGISTRATION
Y
HOME AP
Y
SEND
N
N
214
226
202
DECAPSULATE
CREATE ENTRY
216
204
SOURCE MAC
Y
ENCAPSULATE
218
N
206
DESTINATION MAC
Y
ENCAPSULATE
220
N
208
BROADCAST
Y
FORWARD
222
N
210
DESTINATION MAC
Y
FORWARD
224
N
212
FORWARD

FIG.17

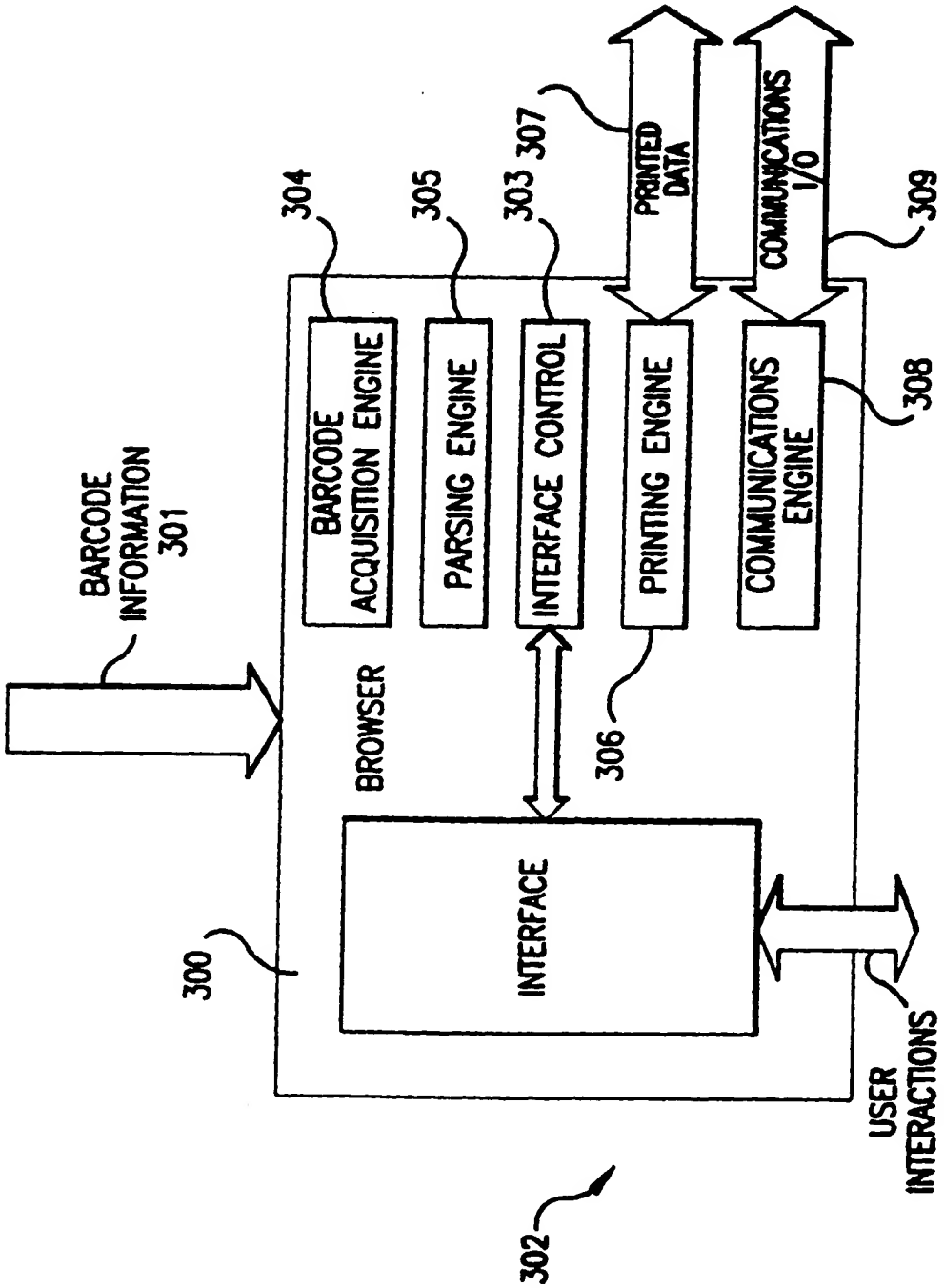
BARCODE INFORMATION 301
BARCODE ACQUISITION ENGINE
PARSING ENGINE
INTERFACE CONTROL
PRINTING ENGINE
COMMUNICATIONS ENGINE
PRINTED DATA
COMMUNICATIONS I/O
304
305
303
307
309
308
306
BROWSER
INTERFACE
300
302
USER INTERACTIONS 310

FIG. 18

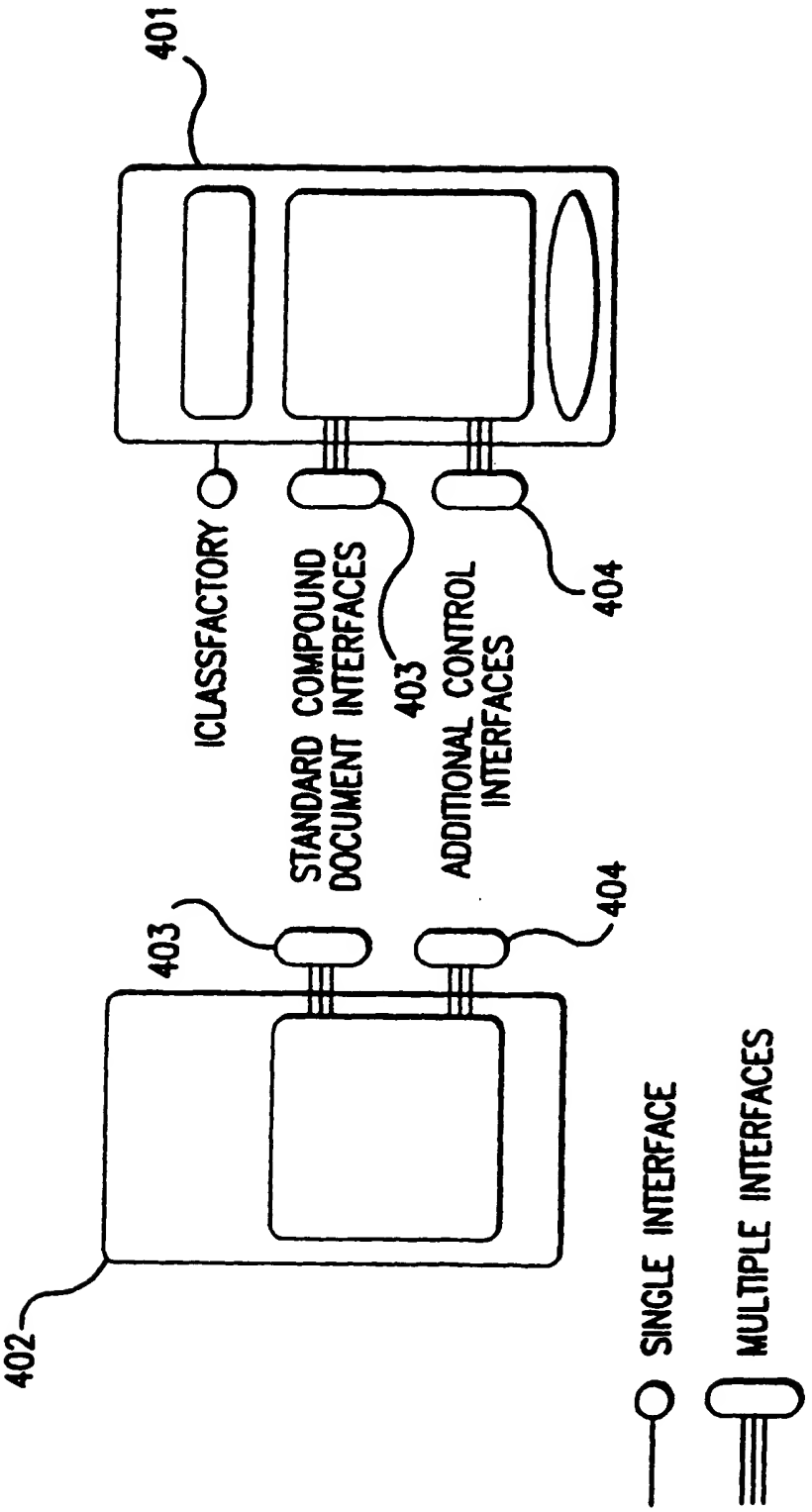
401
ICLASSFACTORY
STANDARD COMPOUND DOCUMENT INTERFACES
403
ADDITIONAL CONTROL INTERFACES
404
404
403
402
SINGLE INTERFACE
MULTIPLE INTERFACES

FIG.19

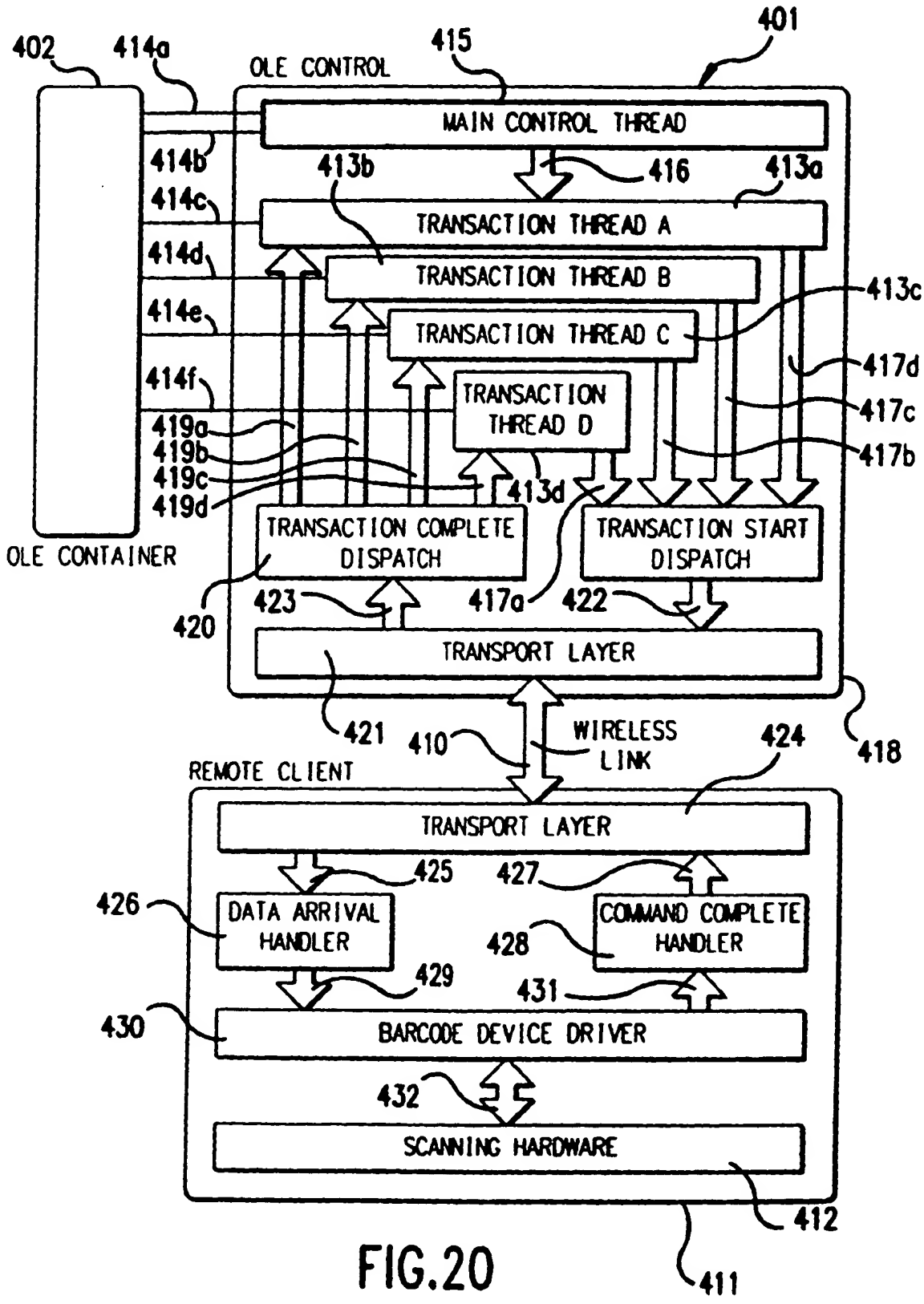
401
402
414a
OLE CONTROL
415
MAIN CONTROL THREAD
414b
413b
416
413a
414c
TRANSACTION THREAD A
414d
TRANSACTION THREAD B
413c
414e
TRANSACTION THREAD C
417d
414f
TRANSACTION THREAD D
417c
419a
419b
419c
419d
417b
413d
TRANSACTION COMPLETE DISPATCH
TRANSACTION START DISPATCH
OLE CONTAINER
420
423
417a
422
TRANSPORT LAYER
421
410
WIRELESS LINK
418
424
REMOTE CLIENT
TRANSPORT LAYER
425
427
426
DATA ARRIVAL HANDLER
COMMAND COMPLETE HANDLER
428
429
431
430
BARCODE DEVICE DRIVER
432
SCANNING HARDWARE
412
411

FIG.20

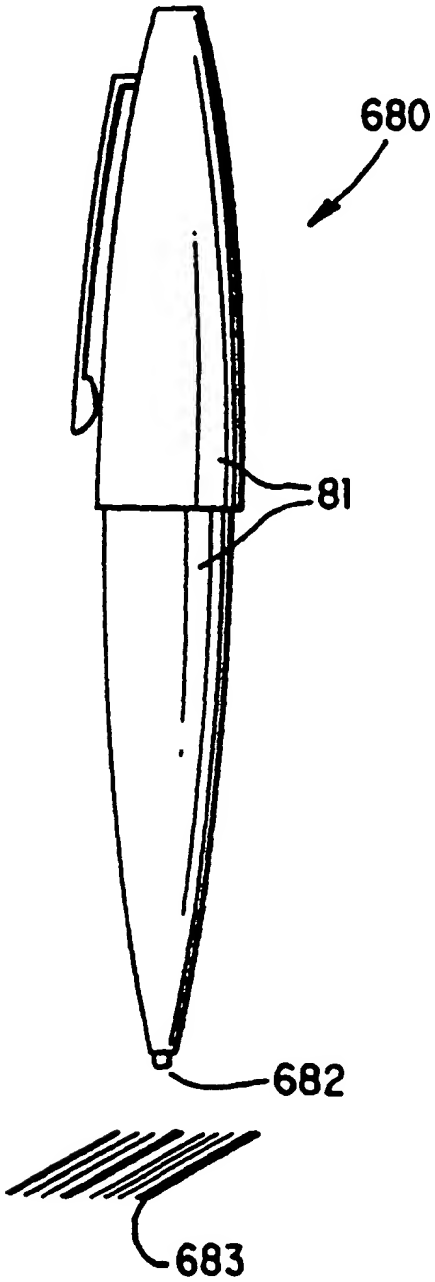
680
81
682
683

FIG. 21

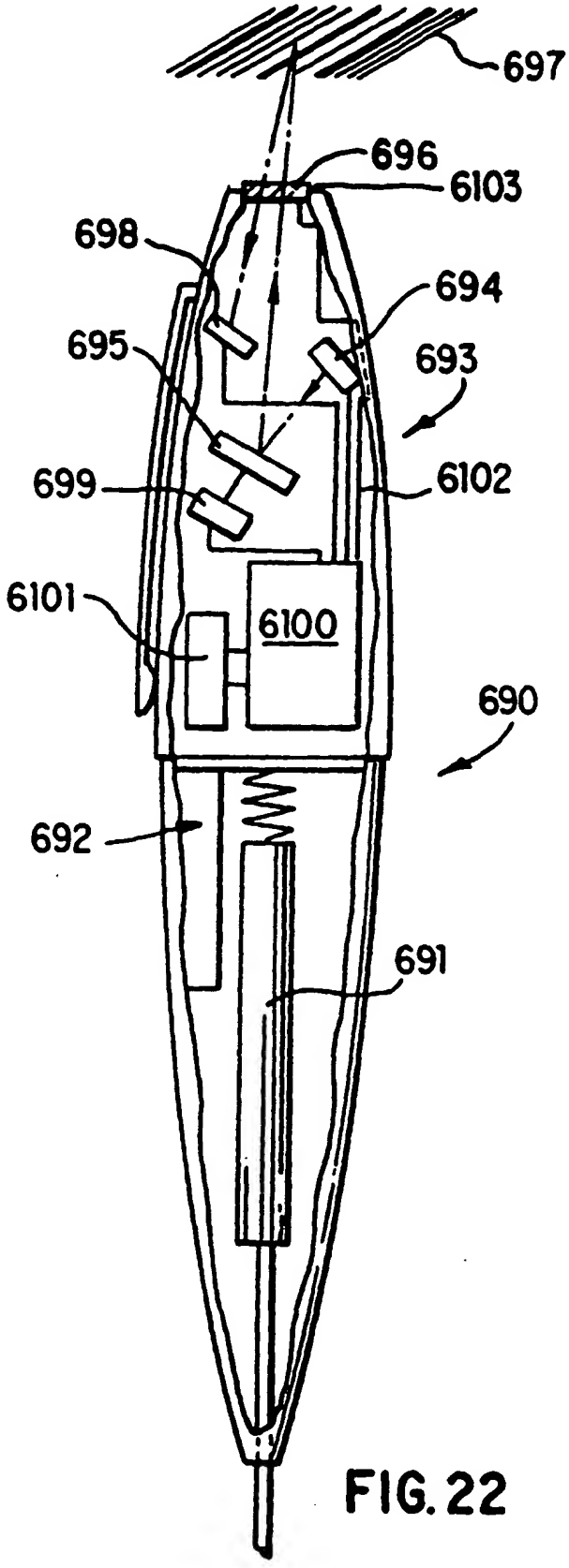
697
696
6103
698
694
695
693
699
6102
6101
6100
690
692
691

FIG. 22

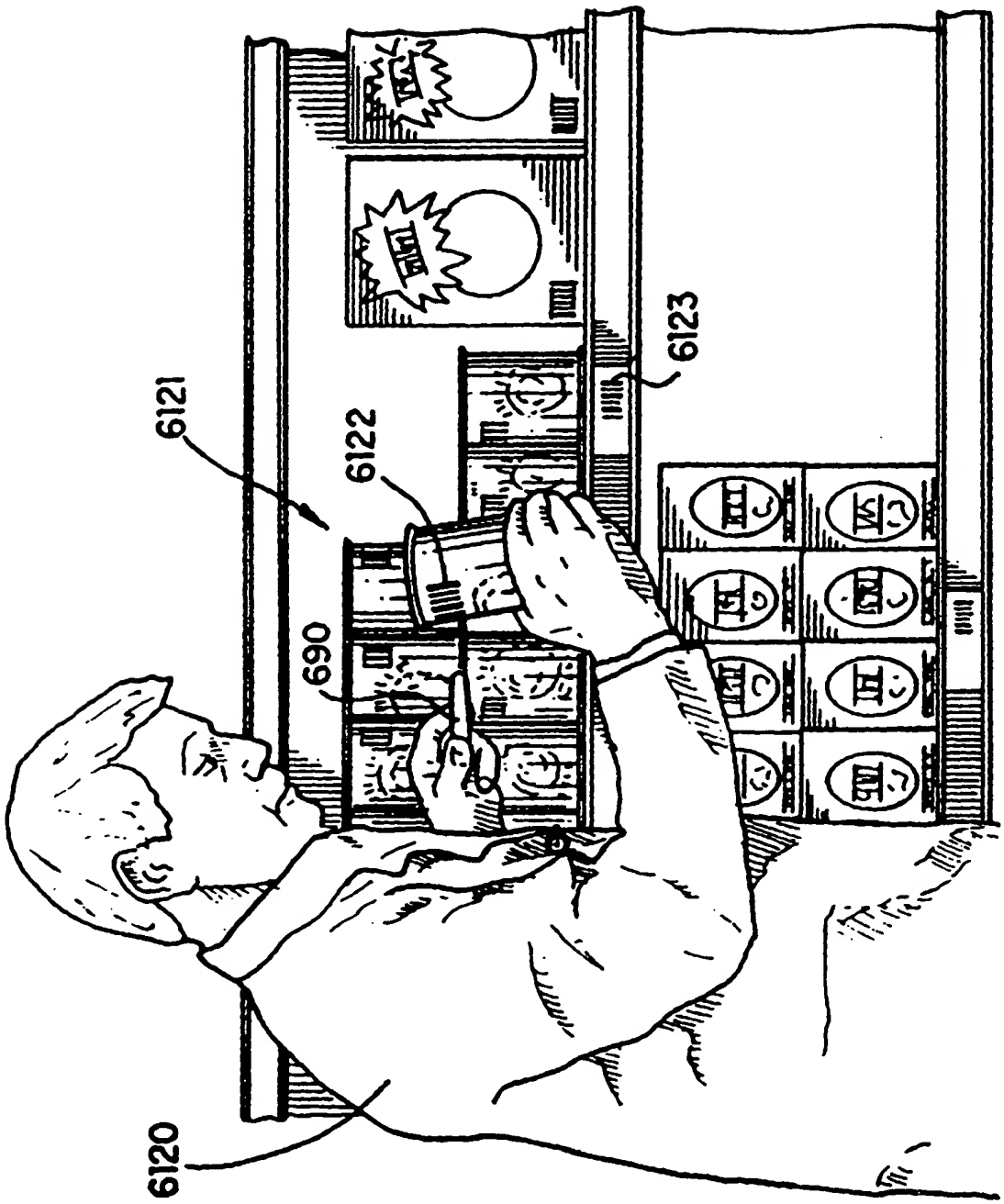

FIG.23a

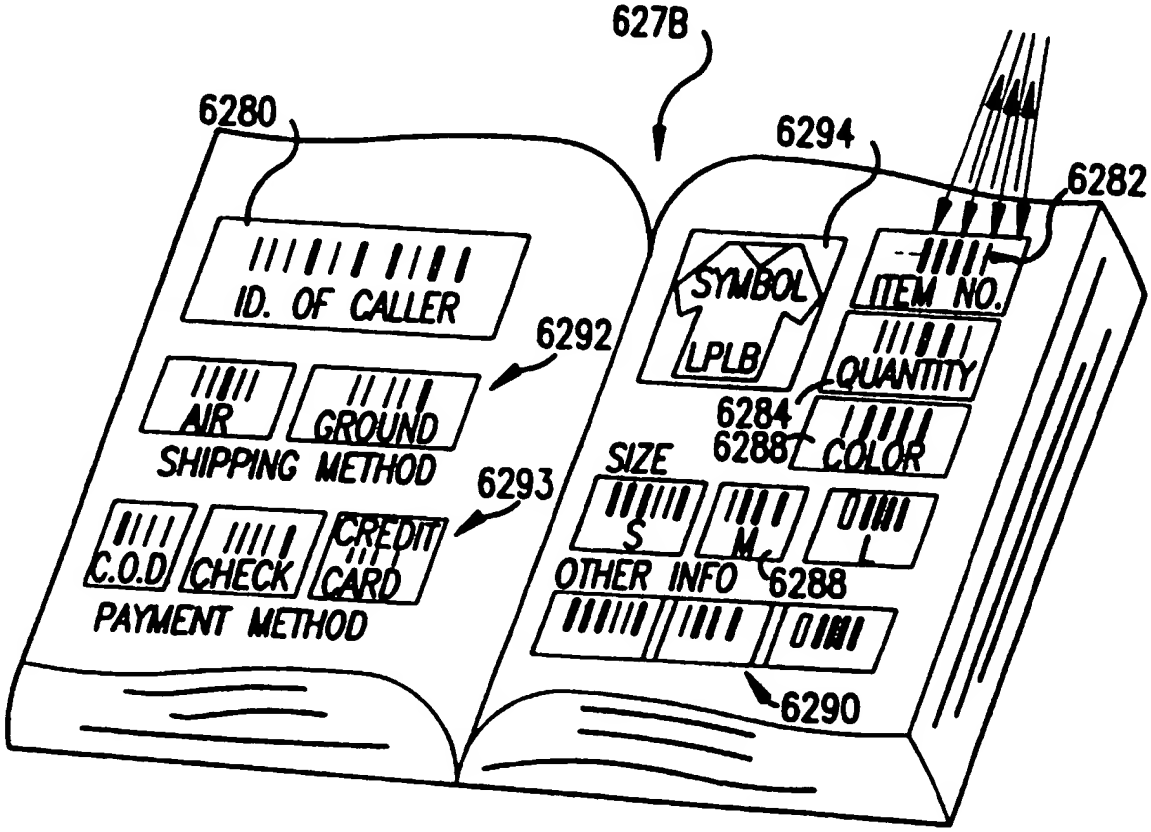
627B
6280
6294
6282
ID. OF CALLER
6292
AIR
GROUND
SHIPPING METHOD
6293
C.O.D
CHECK
CREDIT CARD
PAYMENT METHOD
SYMBOL
LPLB
ITEM NO.
QUANTITY
6284
6288
COLOR
SIZE
S
M
L
OTHER INFO
6288
6290

FIG.23b

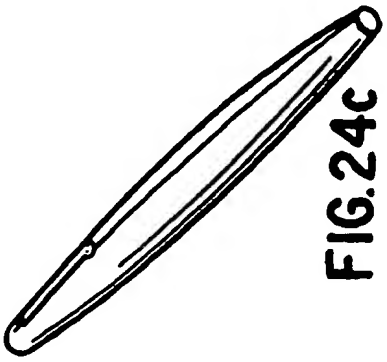

FIG.24c

FIG.24d

FIG. 24a

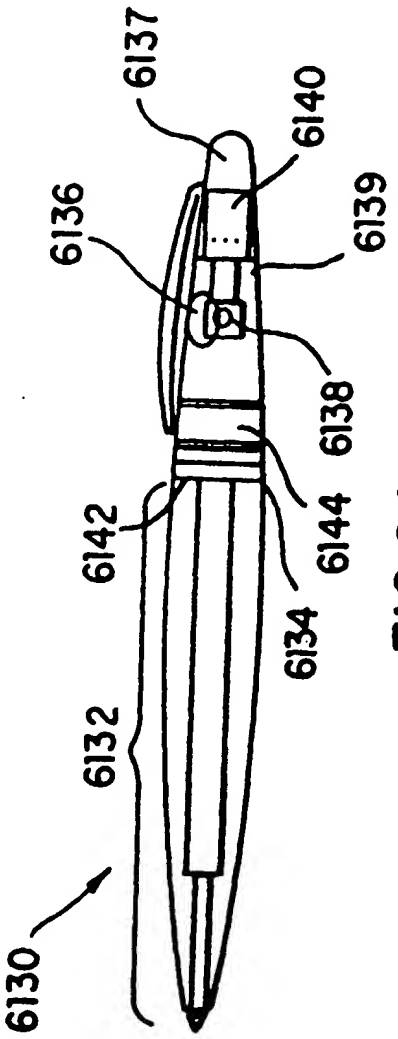

FIG.24b

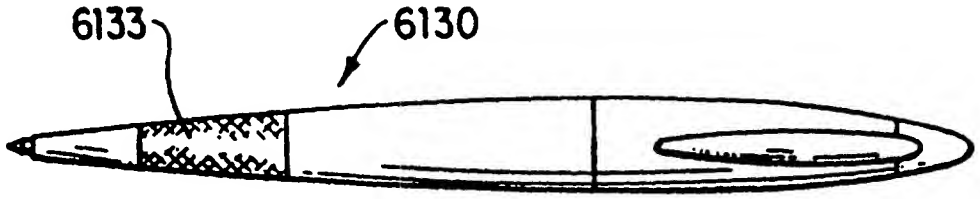

FIG.25a

FIG.25d

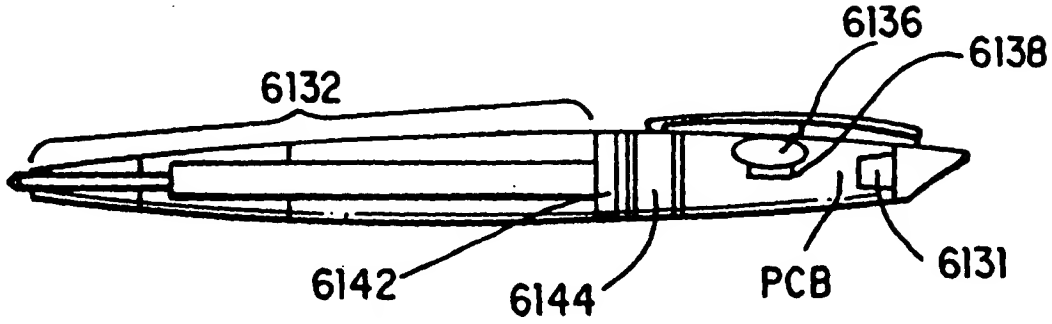

FIG.25b

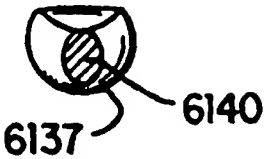

FIG.25e

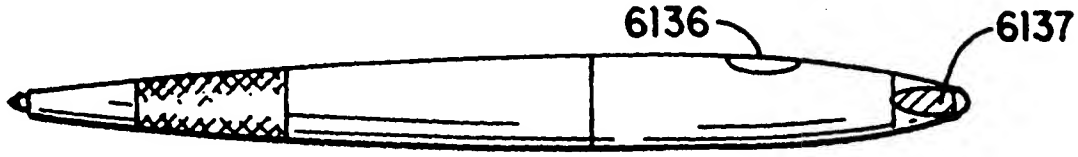

FIG. 25c

EP 1 065 605 A2

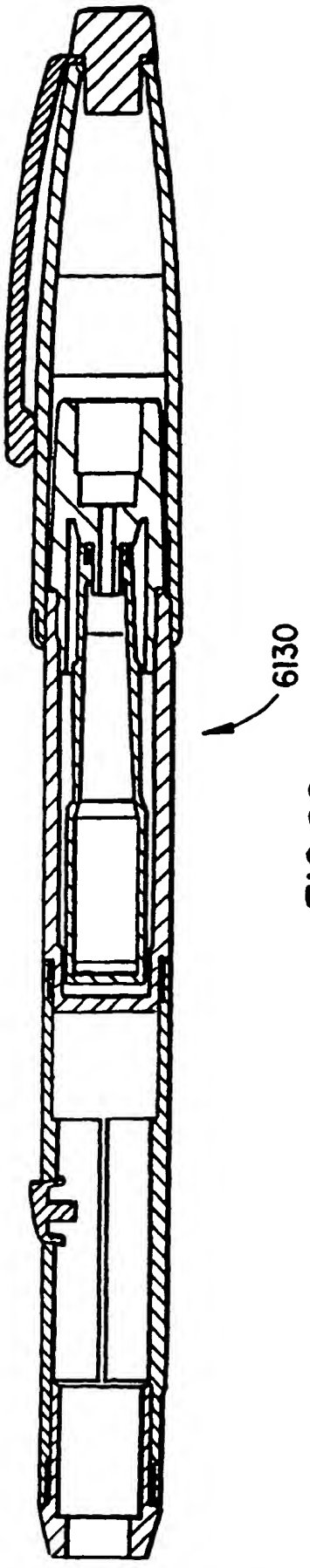

FIG.26a

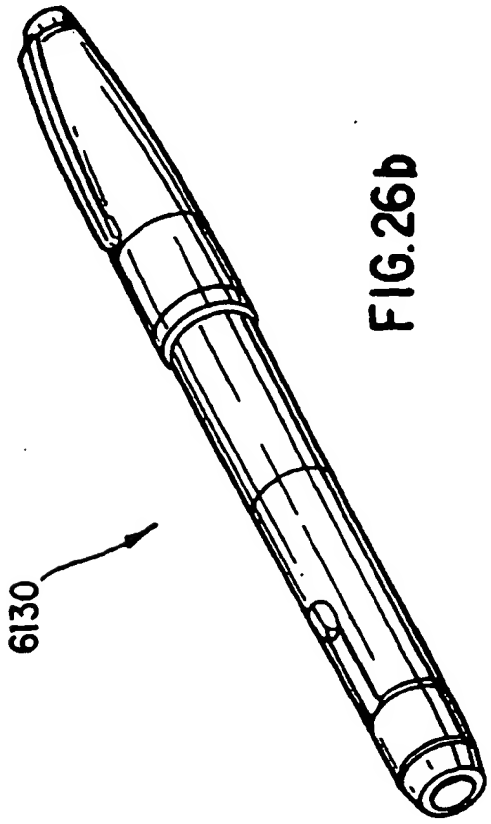

FIG.26b

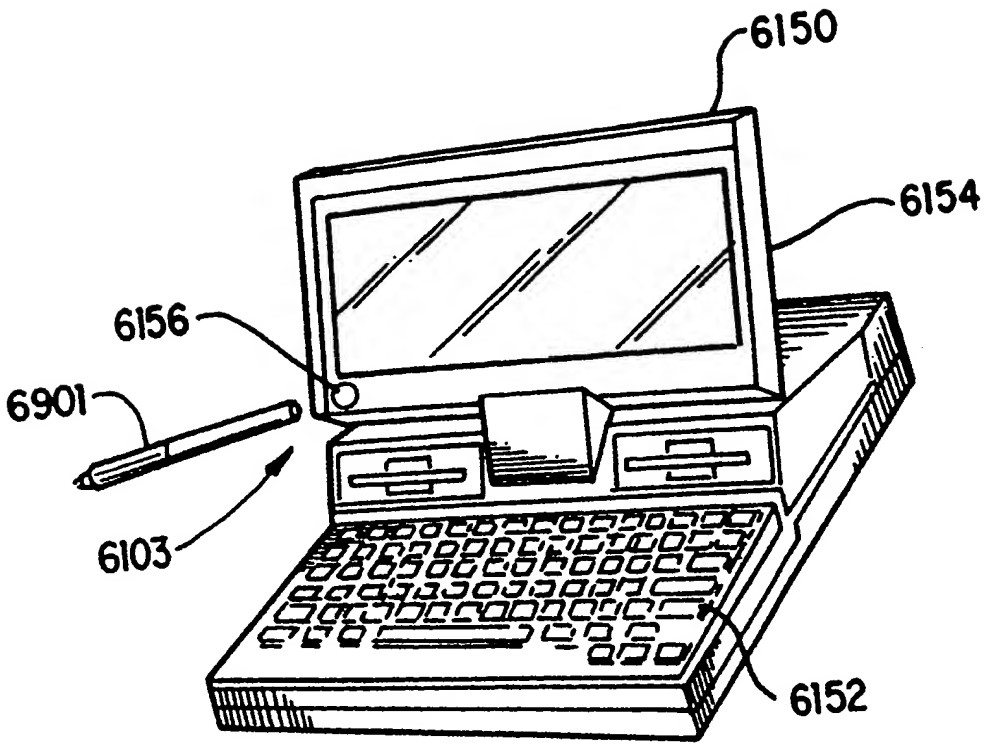

FIG. 27a

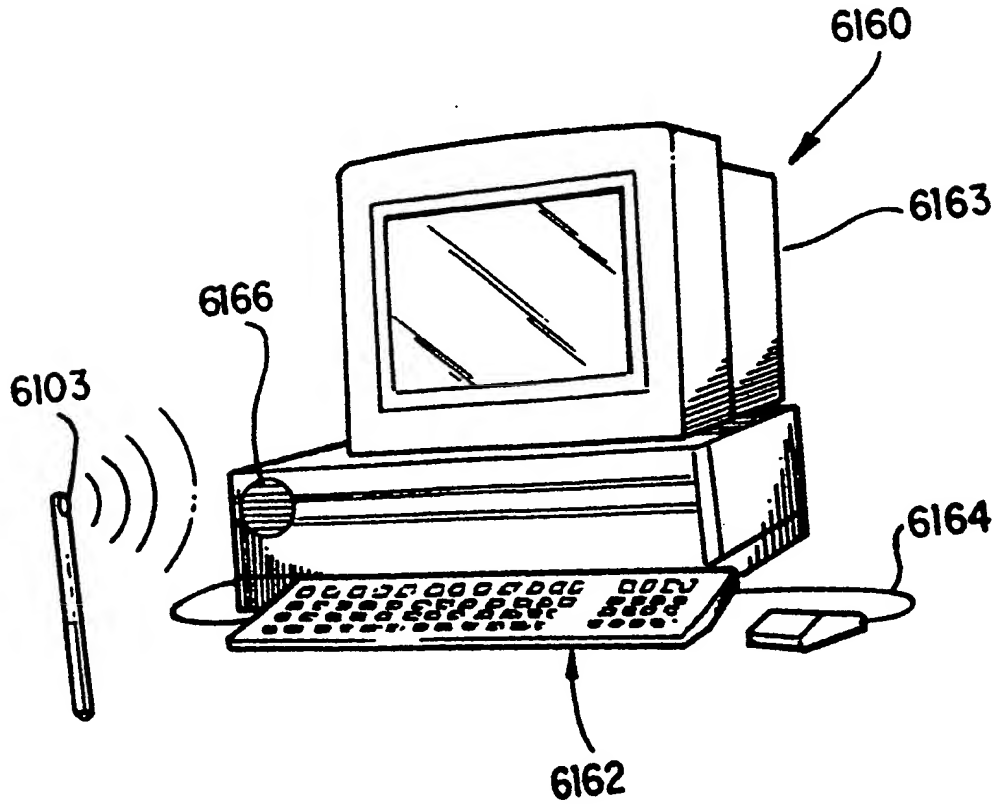

FIG. 27b

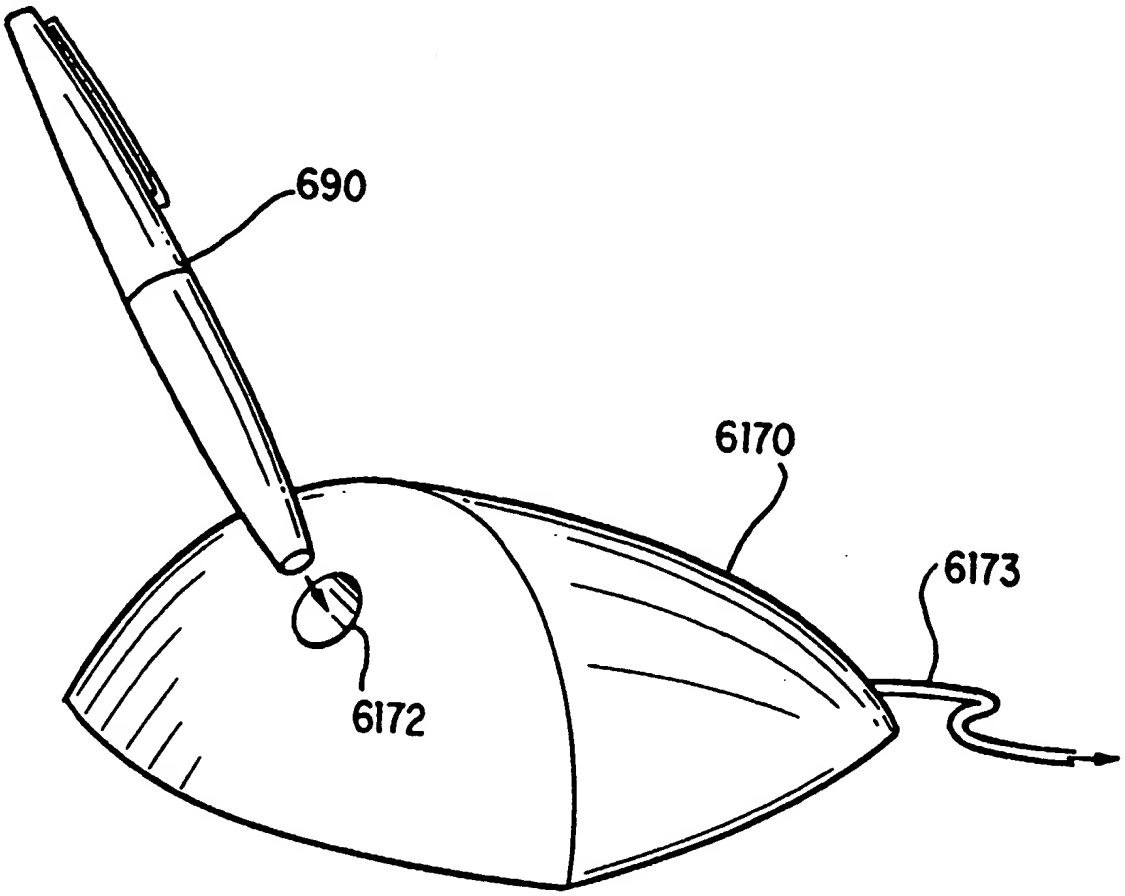

FIG. 28

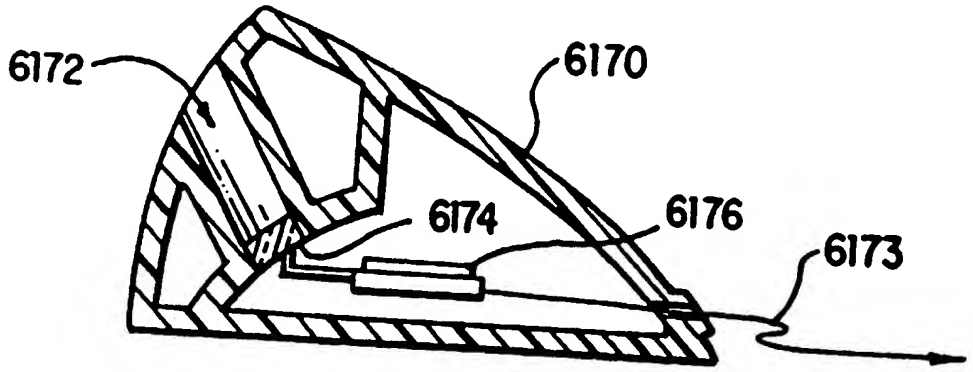

FIG. 29

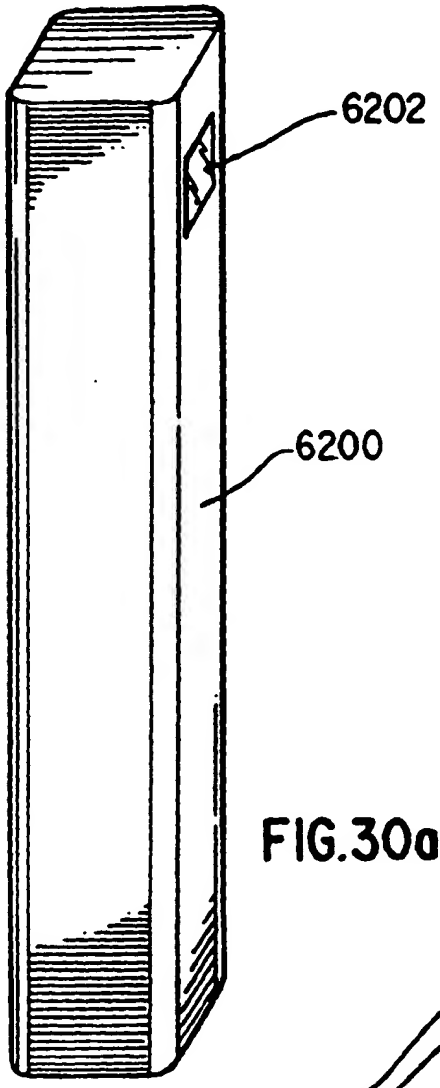

FIG.30a

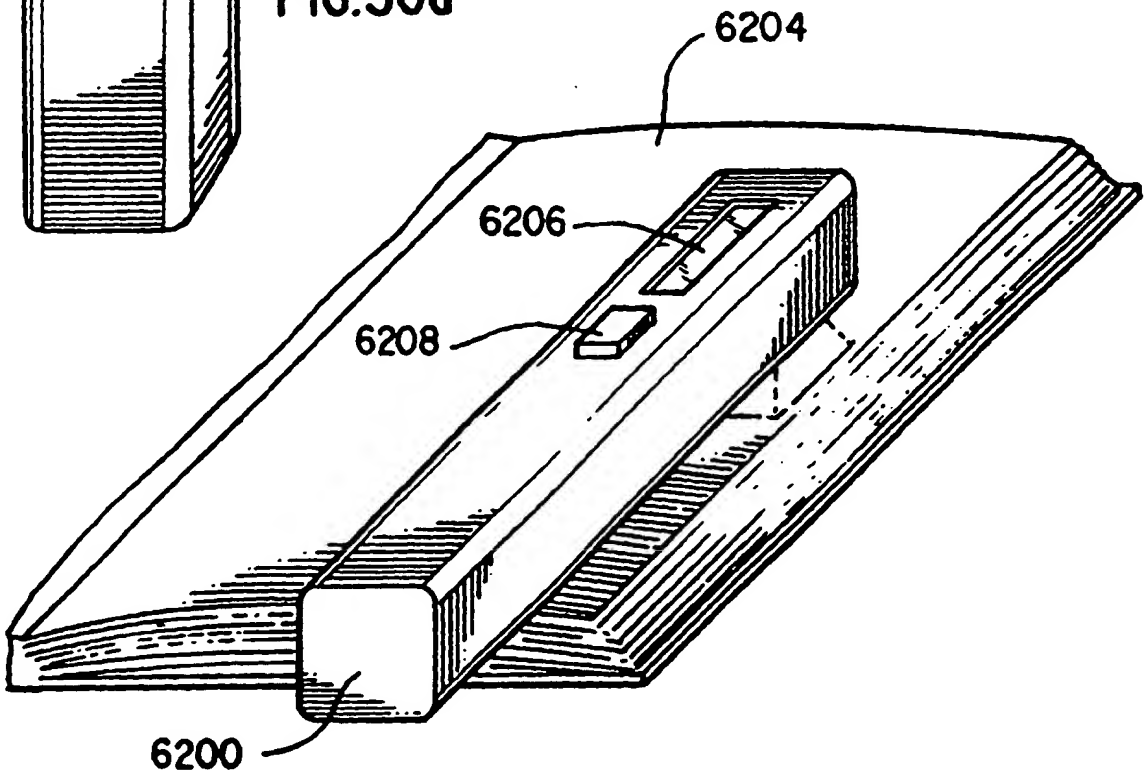

FIG. 30b

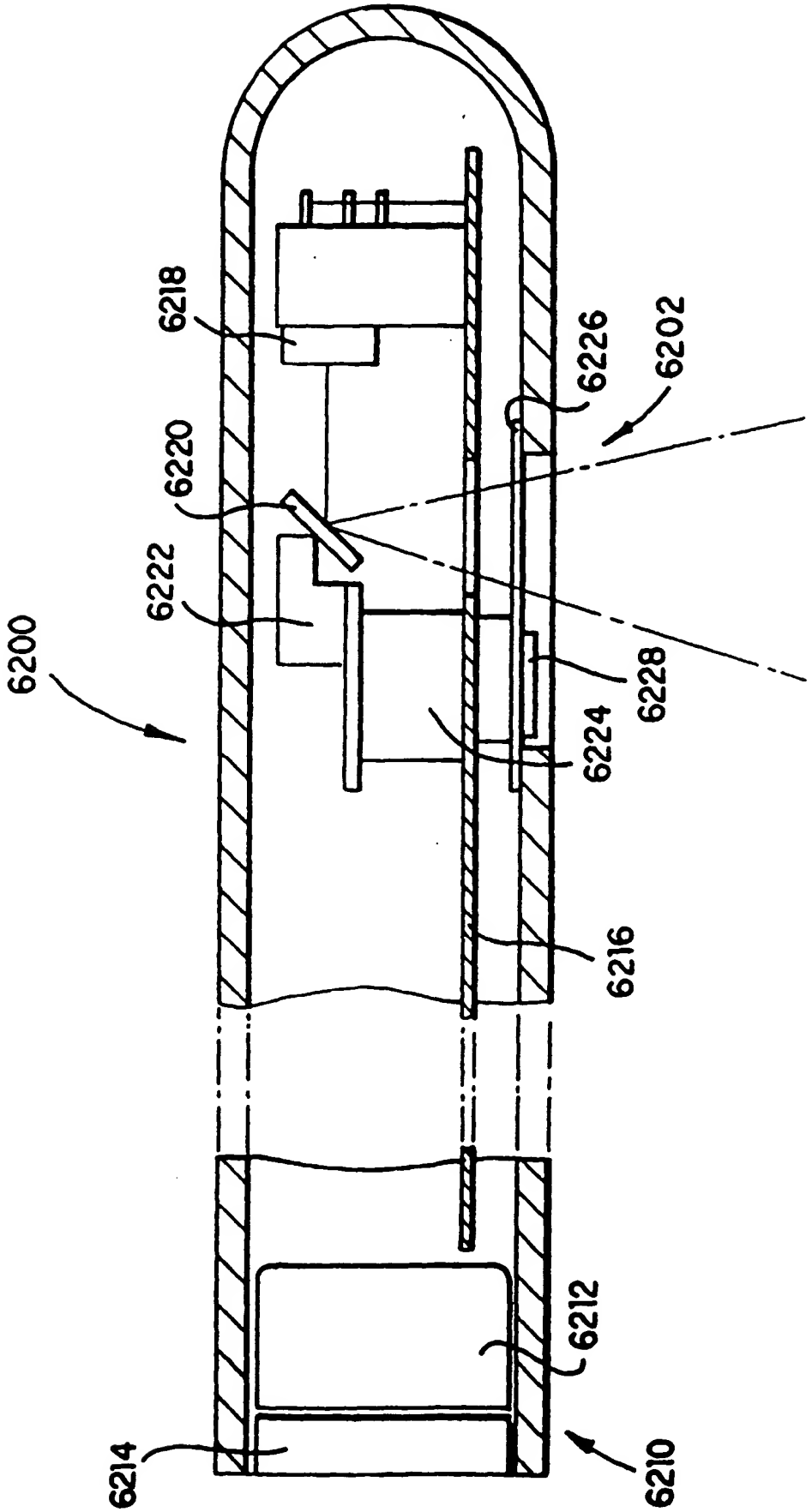

FIG.30c

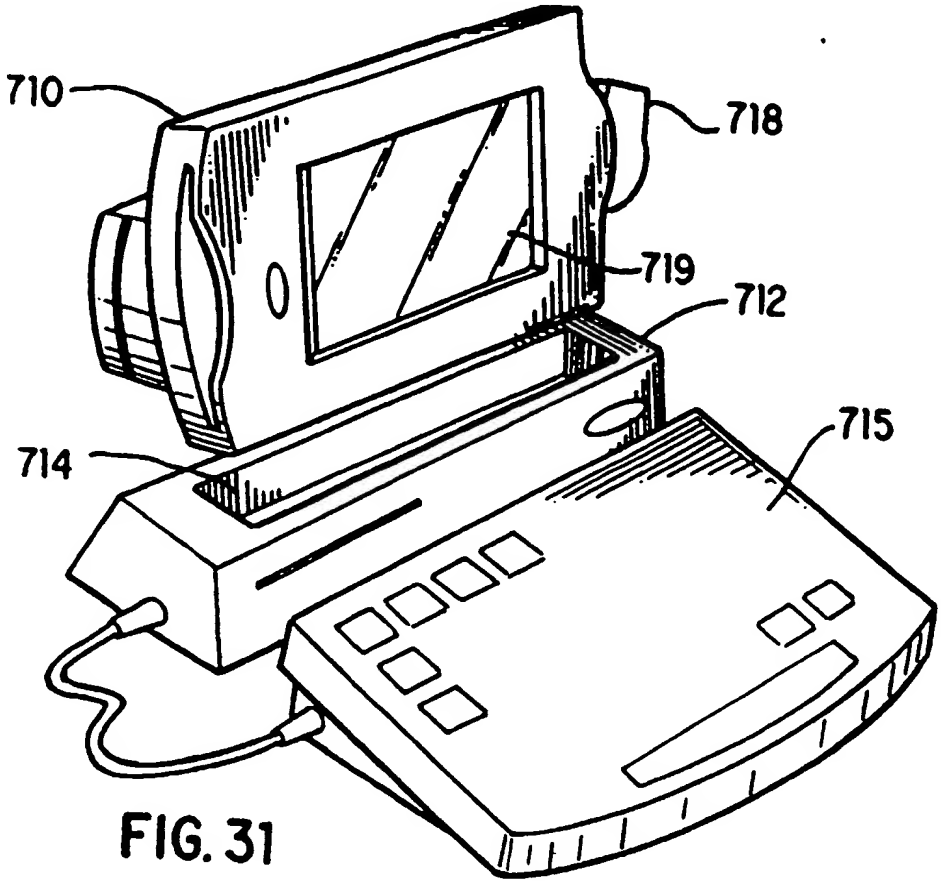

FIG. 31

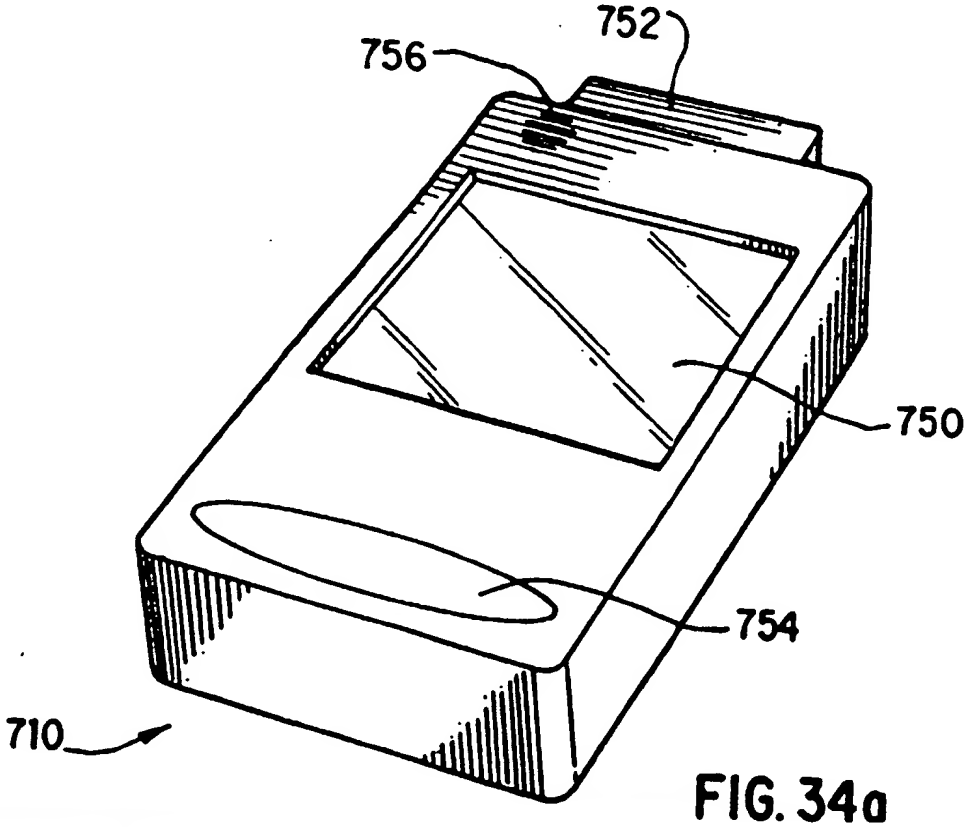

FIG. 34a

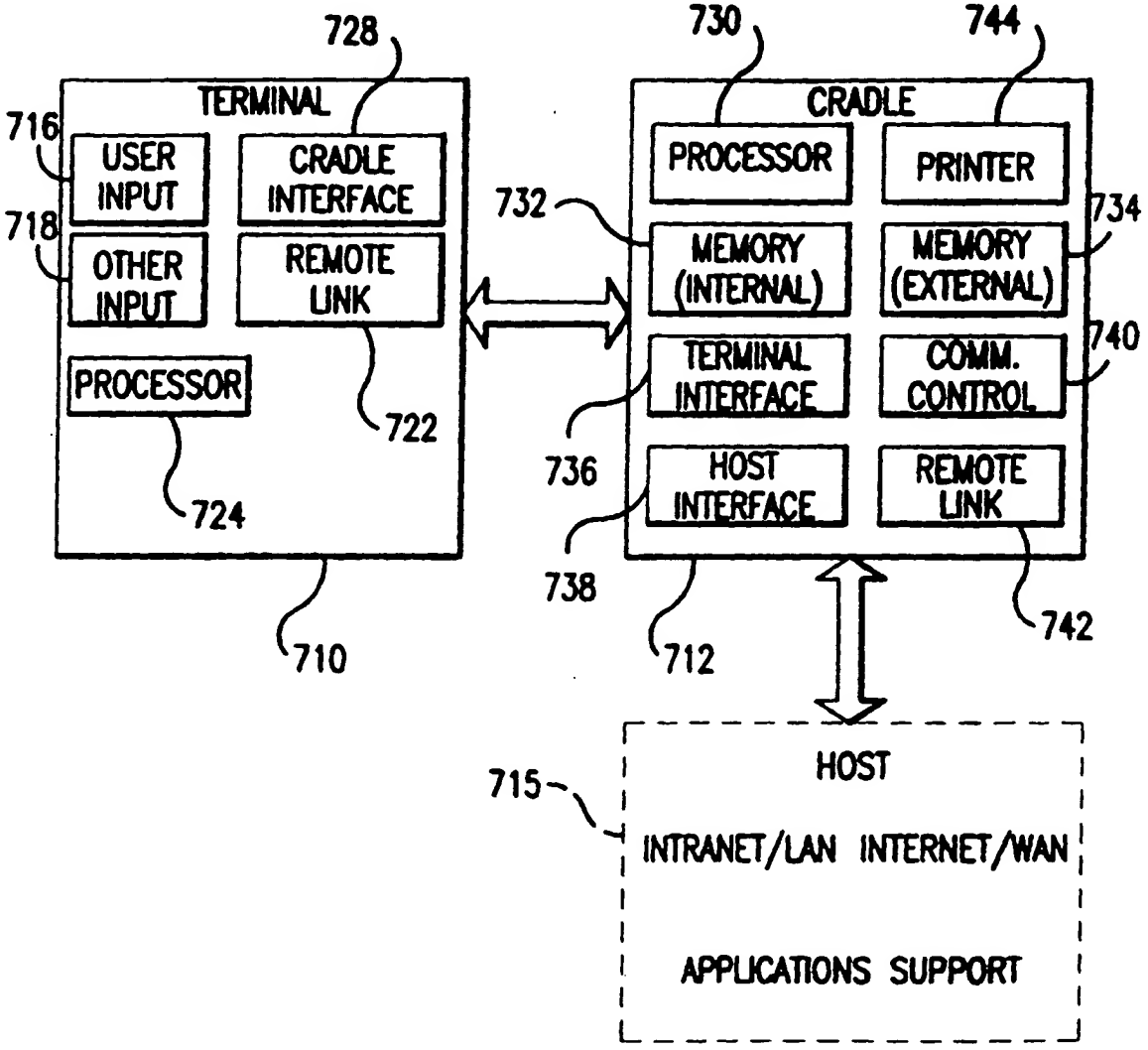
728
730
744
TERMINAL
CRADLE
716
USER INPUT
CRADLE INTERFACE
PROCESSOR
PRINTER
732
734
718
OTHER INPUT
REMOTE LINK
MEMORY (INTERNAL)
MEMORY (EXTERNAL)
740
TERMINAL INTERFACE
COMM. CONTROL
PROCESSOR
722
736
HOST INTERFACE
REMOTE LINK
724
738
742
710
712
HOST
715
INTRANET/LAN INTERNET/WAN
APPLICATIONS SUPPORT

FIG.33

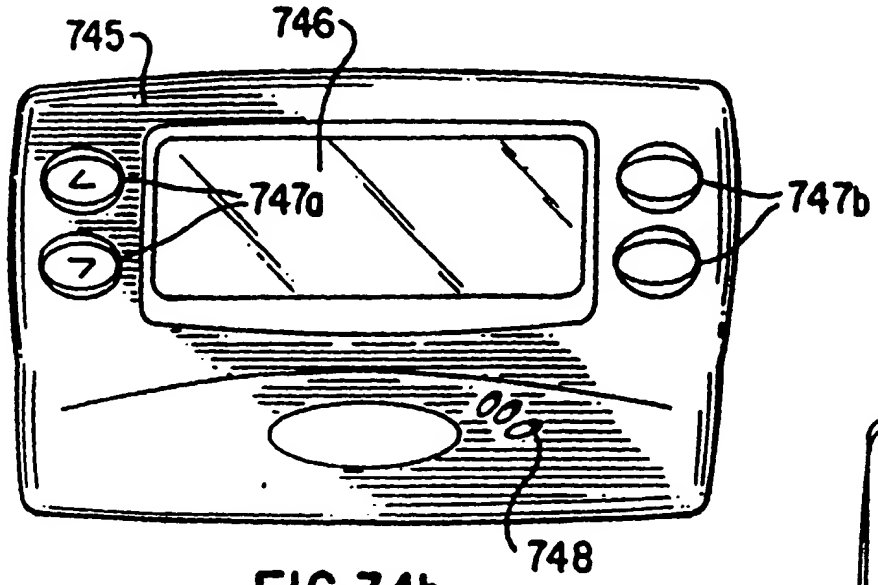

FIG. 34b

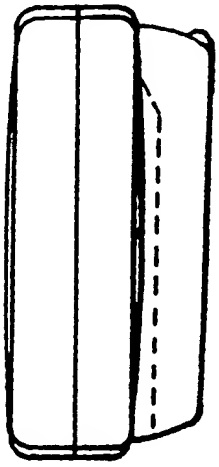

FIG. 34e

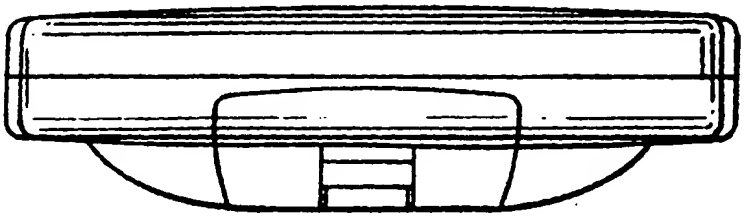

FIG. 34c

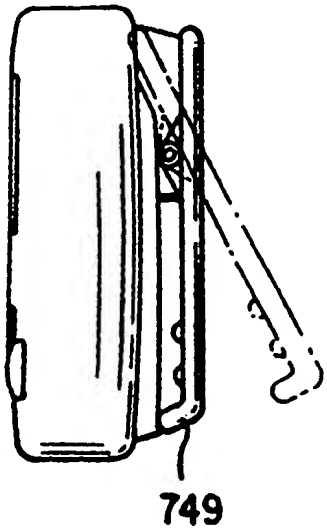

FIG. 34f

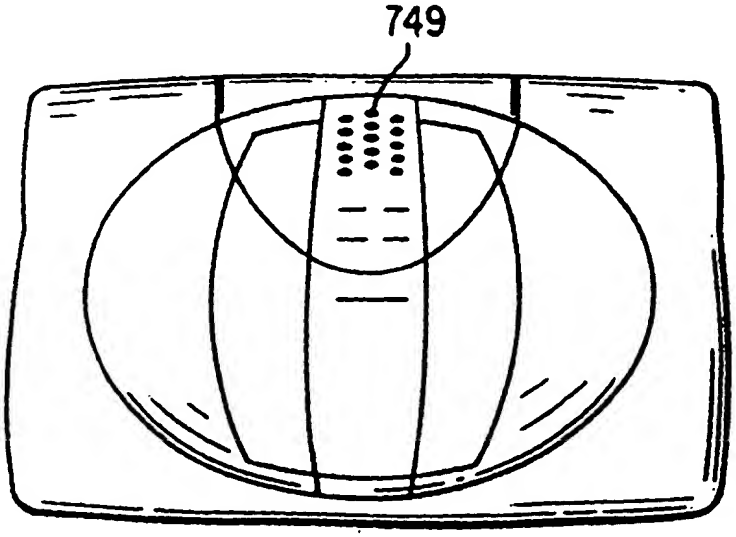

FIG. 34d

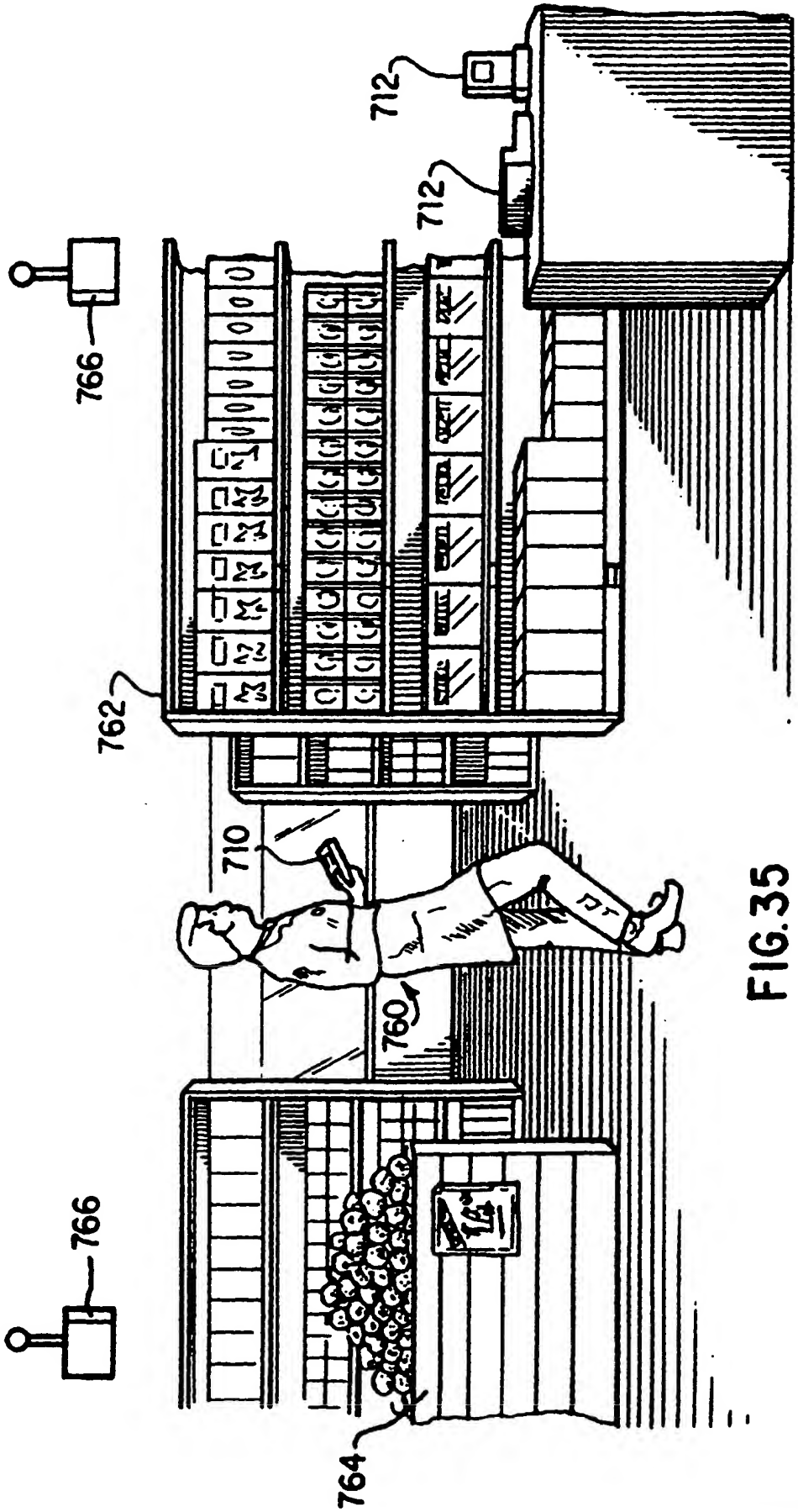

FIG.35

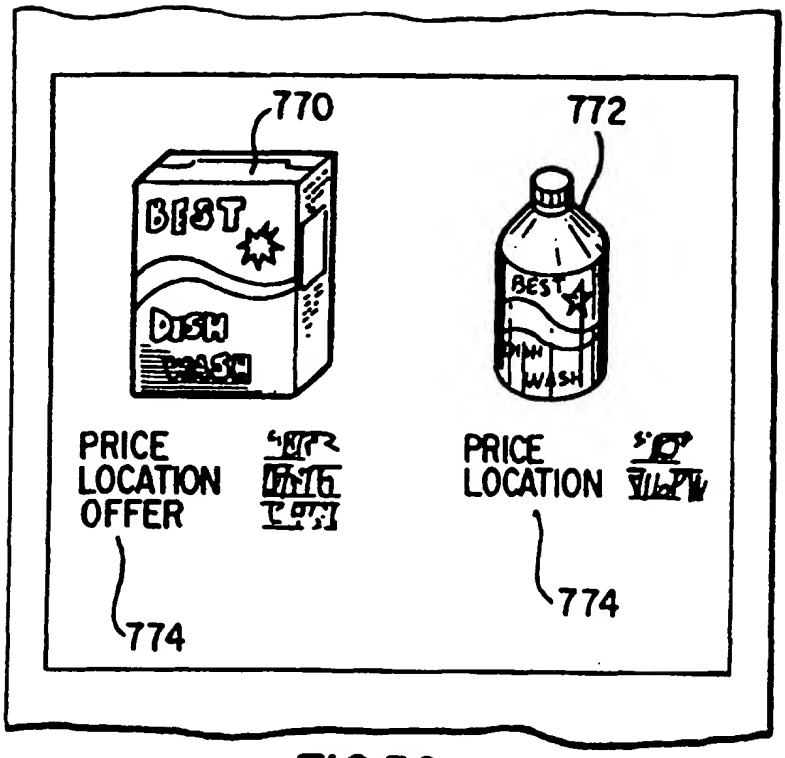
770
772
BEST
DISH
BEST
WASH
PRICE
LOCATION
OFFER
PRICE
LOCATION
774
774

FIG.36

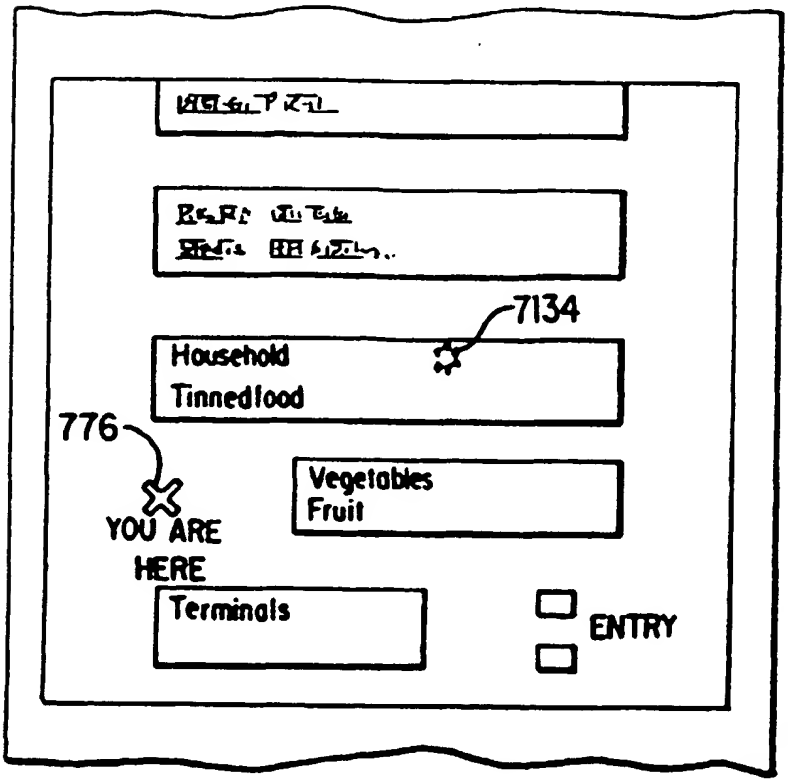
7134
Household
Tinnedfood
776
Vegetables
Fruit
YOU ARE
HERE
Terminals
ENTRY

FIG.37

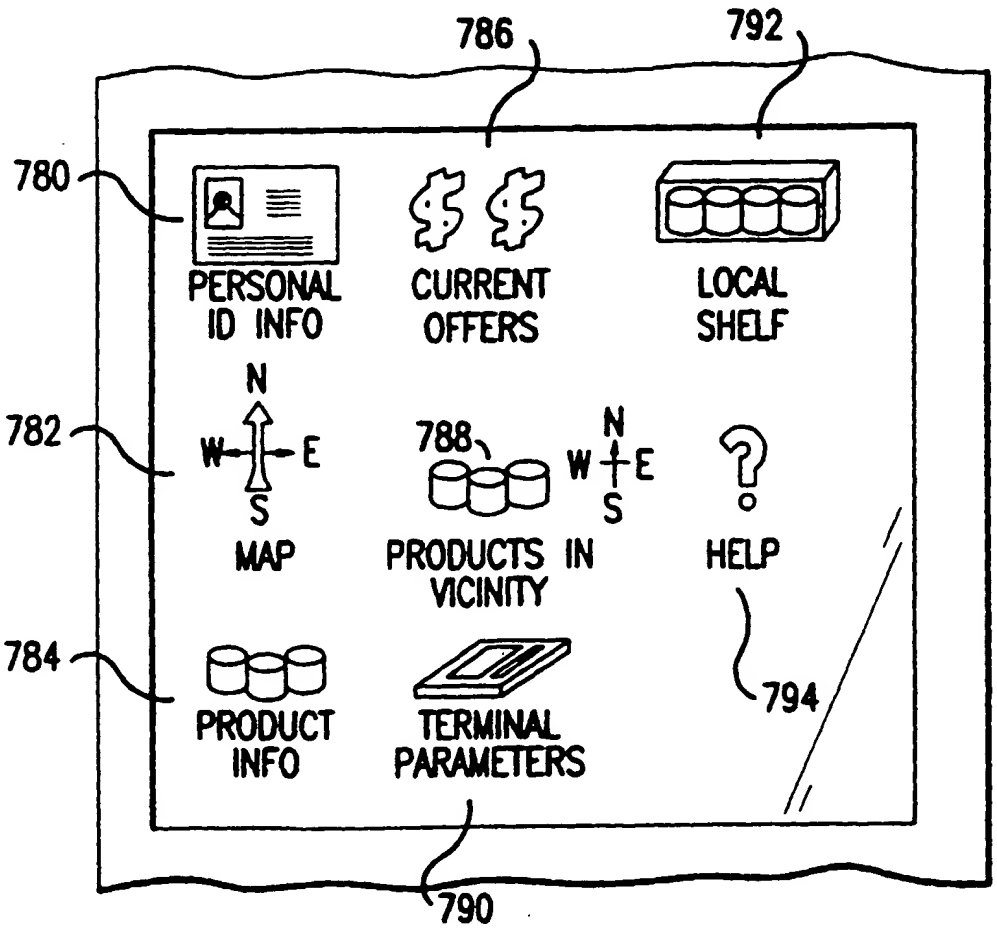
786
792
780
PERSONAL ID INFO
CURRENT OFFERS
LOCAL SHELF
782
N
W
E
S
MAP
788
PRODUCTS IN VICINITY
HELP
784
PRODUCT INFO
TERMINAL PARAMETERS
794
790

FIG.38a

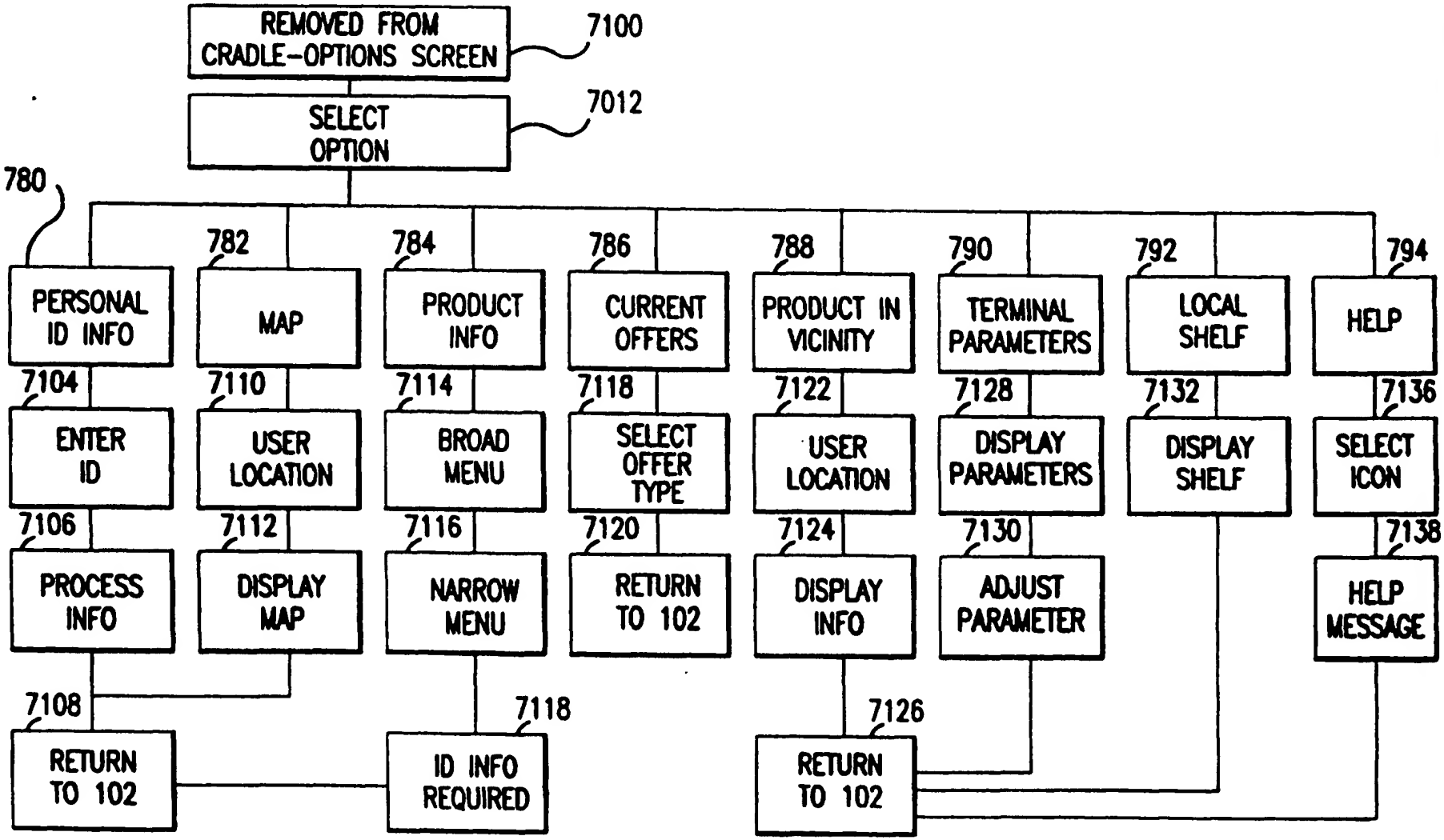
REMOVED FROM CRADLE-OPTIONS SCREEN
7100
SELECT OPTION
7012
780
PERSONAL ID INFO
7104
ENTER ID
7106
PROCESS INFO
7108
RETURN TO 102
782
MAP
7110
USER LOCATION
7112
DISPLAY MAP
784
PRODUCT INFO
7114
BROAD MENU
7116
NARROW MENU
7118
ID INFO REQUIRED
786
CURRENT OFFERS
7118
SELECT OFFER TYPE
7120
RETURN TO 102
788
PRODUCT IN VICINITY
7122
USER LOCATION
7124
DISPLAY INFO
7126
RETURN TO 102
790
TERMINAL PARAMETERS
7128
DISPLAY PARAMETERS
7130
ADJUST PARAMETER
792
LOCAL SHELF
7132
DISPLAY SHELF
794
HELP
7136
SELECT ICON
7138
HELP MESSAGE

FIG.38b

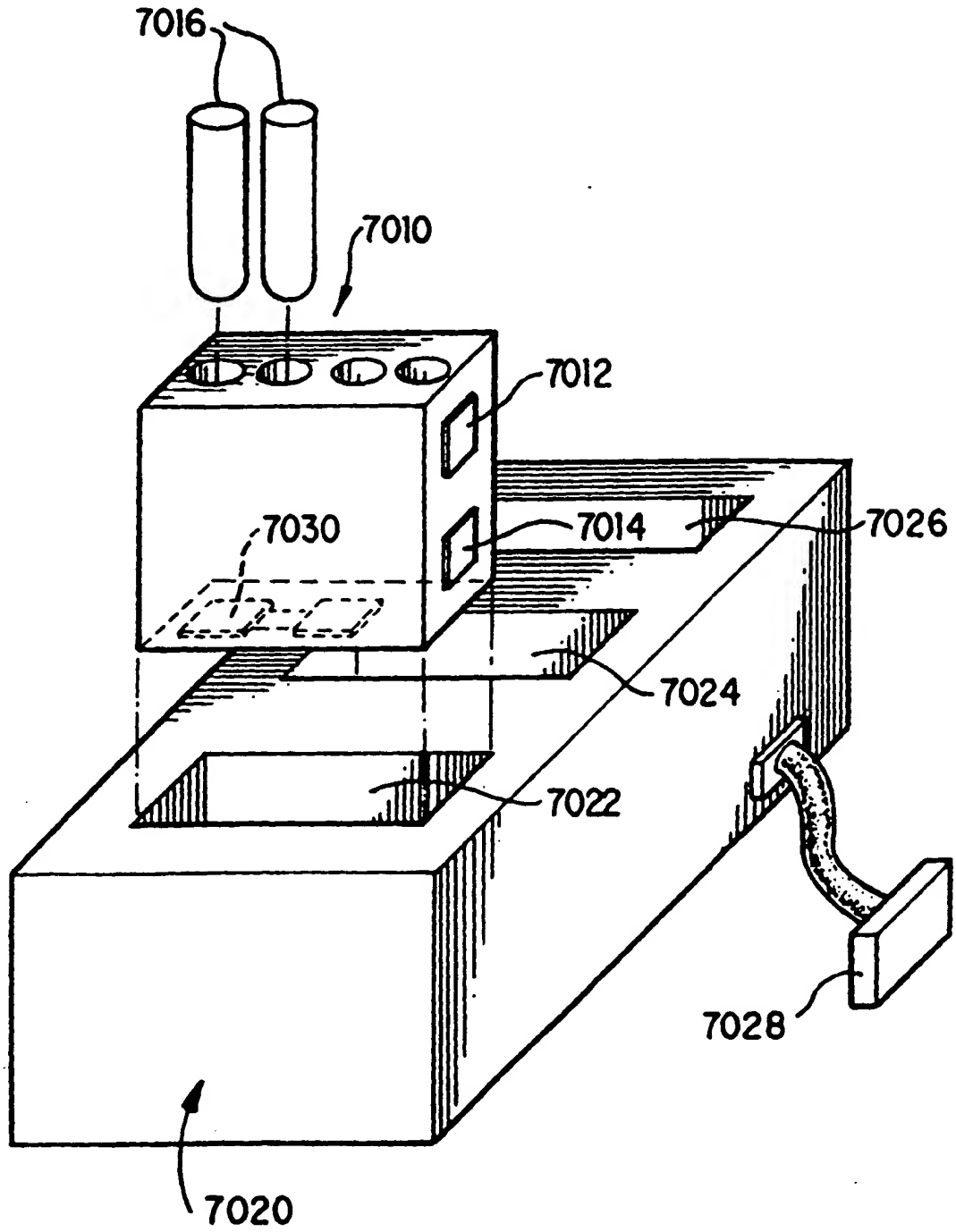

FIG. 39

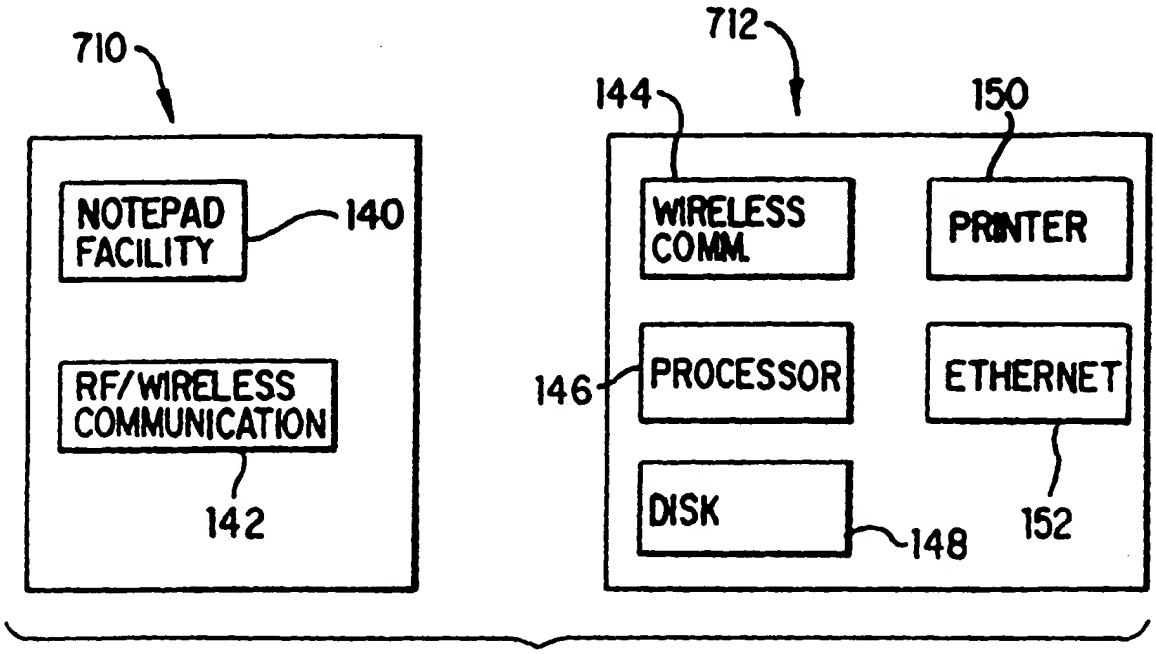
710
712
144
150
NOTEPAD FACILITY
140
WIRELESS COMM.
PRINTER
RF/WIRELESS COMMUNICATION
142
146
PROCESSOR
ETHERNET
DISK
148
152

FIG. 40

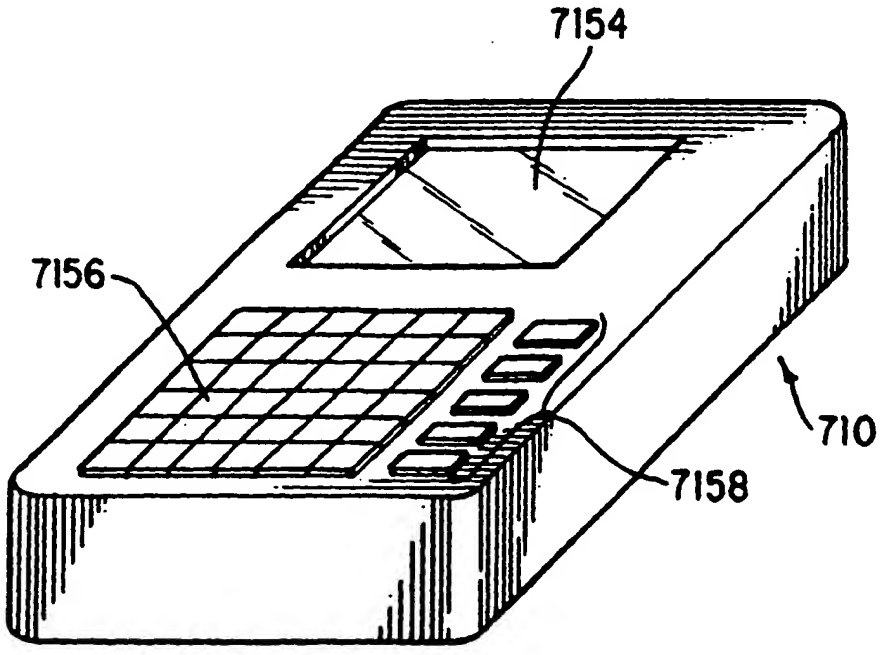
7154
7156
710
7158

FIG. 41

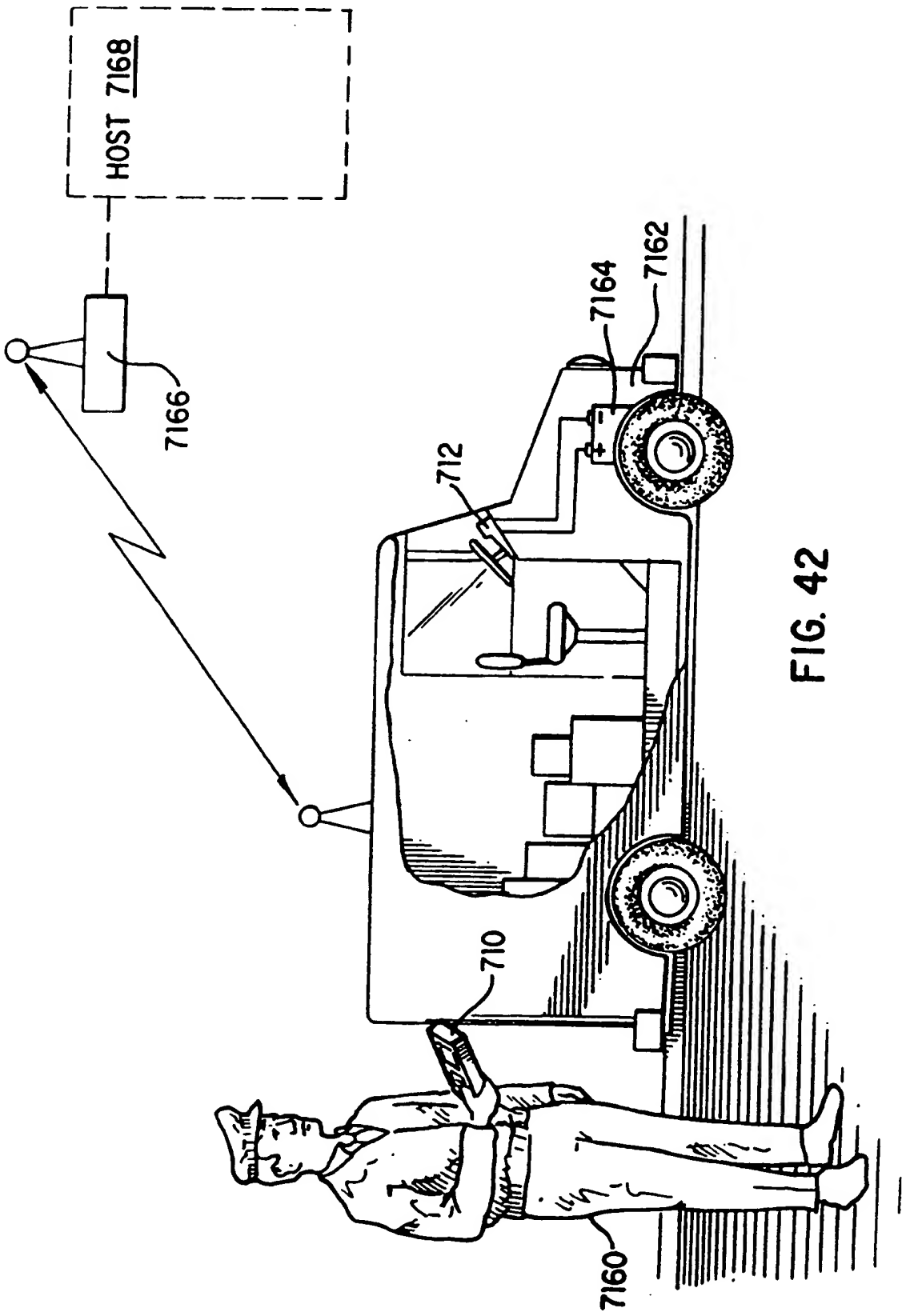

FIG. 42

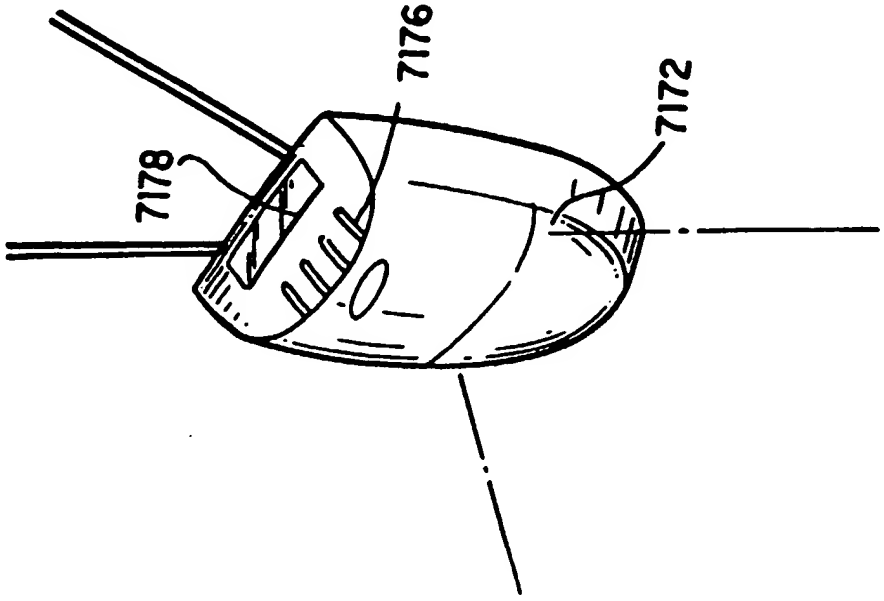

FIG. 43b

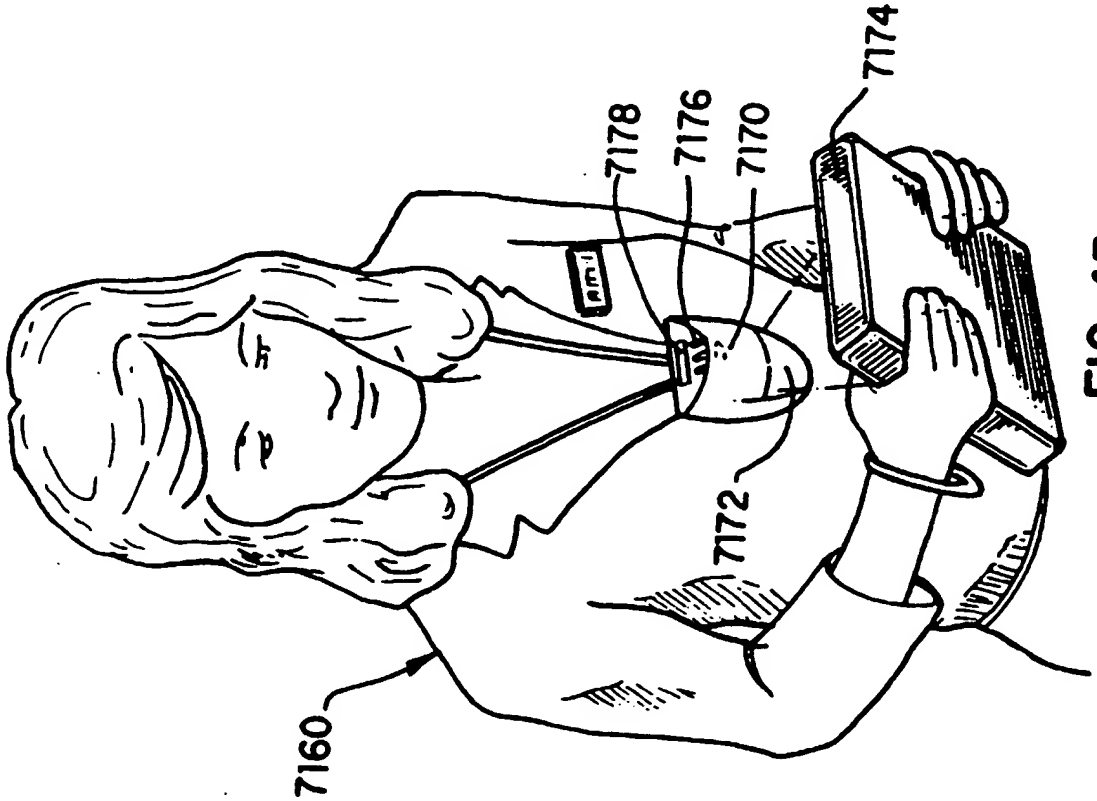

FIG. 43a

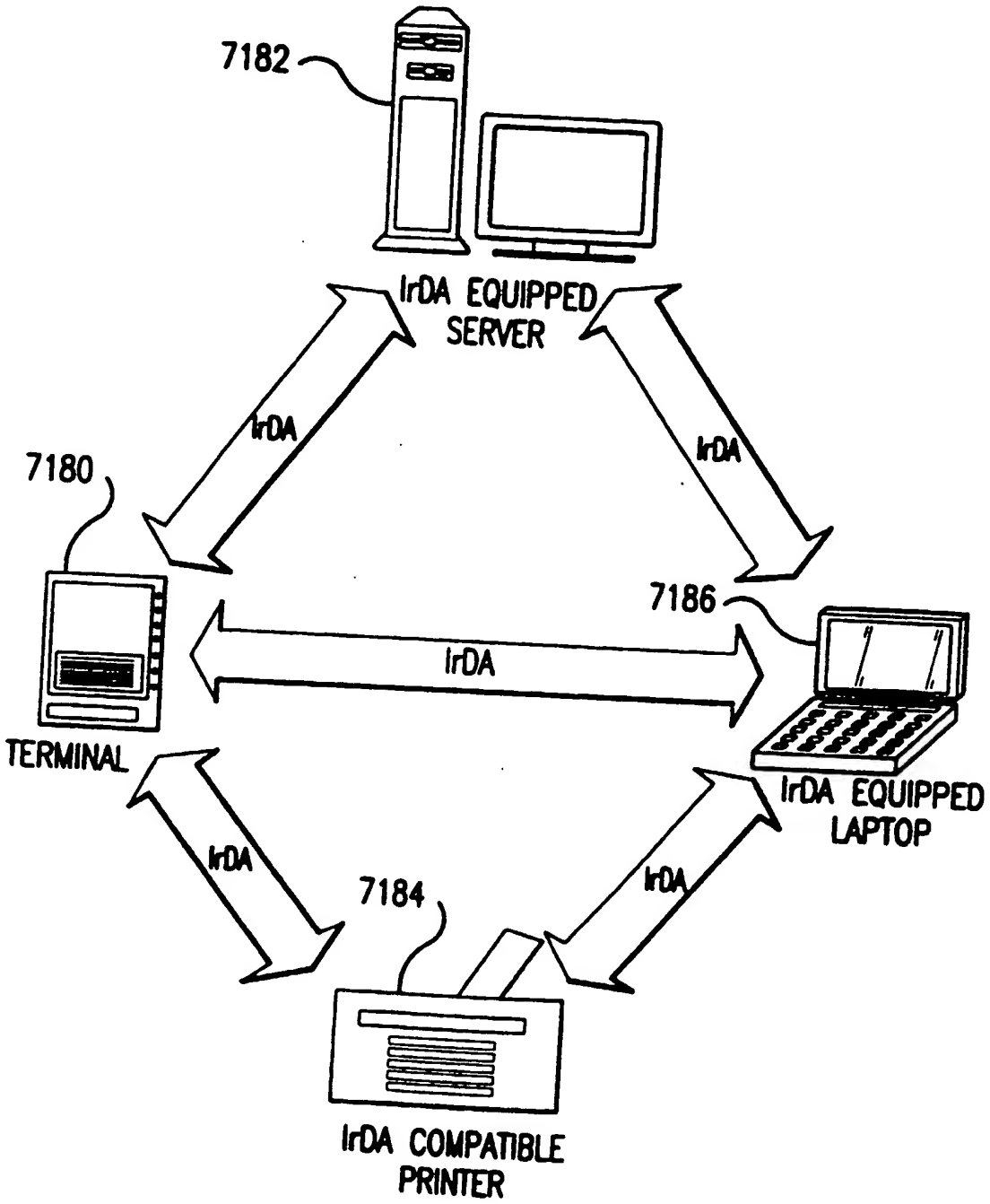
7182
IrDA EQUIPPED SERVER
IrDA
IrDA
7180
7186
IrDA
TERMINAL
IrDA EQUIPPED LAPTOP
IrDA
IrDA
7184
IrDA COMPATIBLE PRINTER

FIG.44

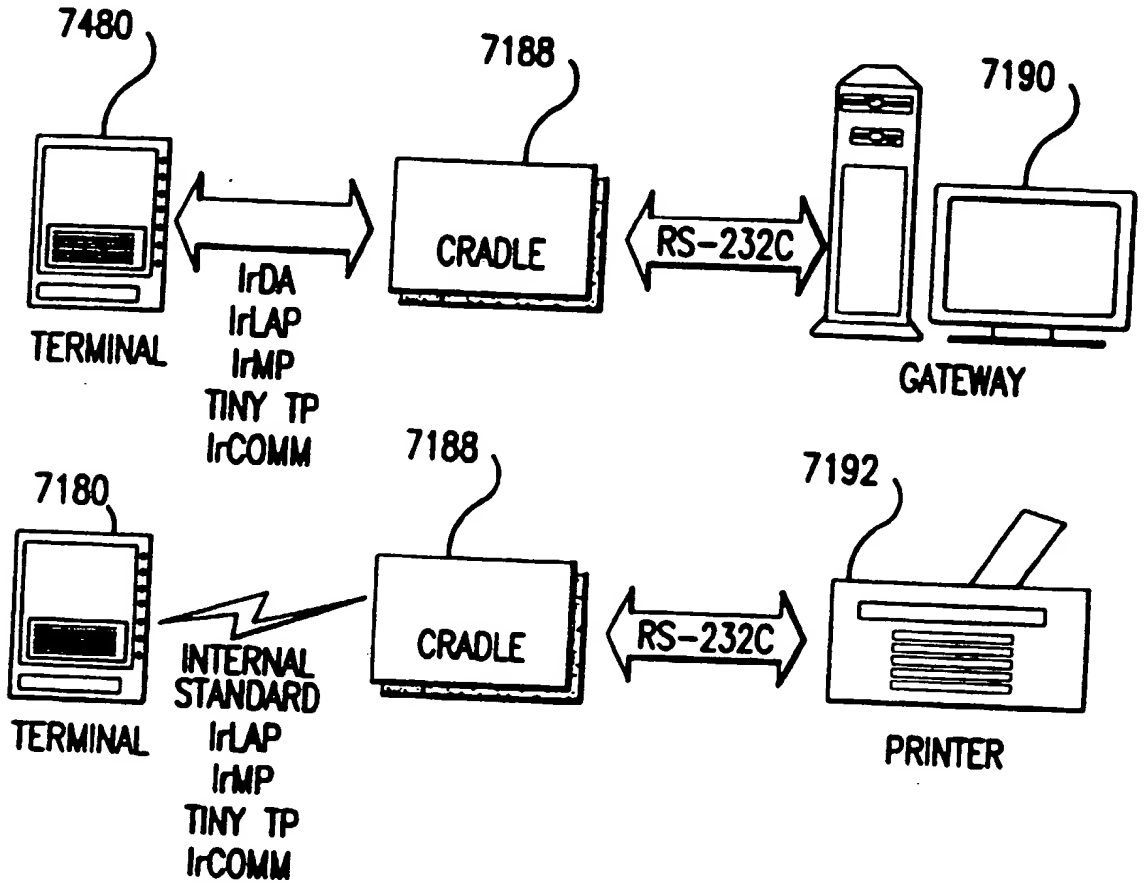
7480
7188
7190
CRADLE
RS-232C
TERMINAL
IrDA
IrLAP
IrMP
TINY TP
IrCOMM
GATEWAY
7180
7188
7192
CRADLE
RS-232C
INTERNAL
STANDARD
IrLAP
IrMP
TINY TP
IrCOMM
TERMINAL
PRINTER

FIG.45

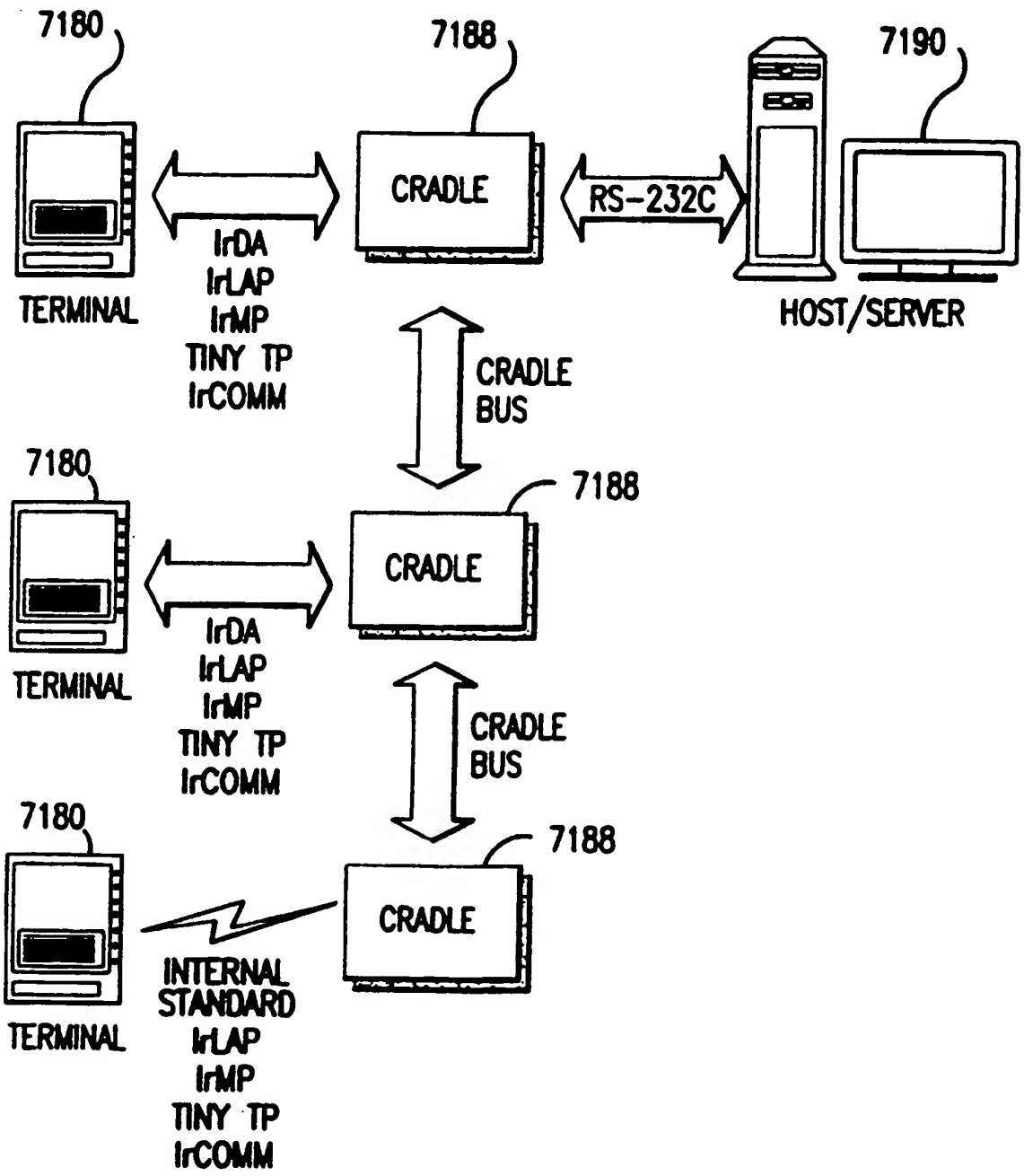
7180
7188
7190
CRADLE
RS-232C
TERMINAL
IrDA
IrLAP
IrMP
TINY TP
IrCOMM
HOST/SERVER
CRADLE
BUS
7180
7188
CRADLE
TERMINAL
IrDA
IrLAP
IrMP
TINY TP
IrCOMM
CRADLE
BUS
7180
7188
CRADLE
INTERNAL
STANDARD
IrLAP
IrMP
TINY TP
IrCOMM
TERMINAL

FIG.46

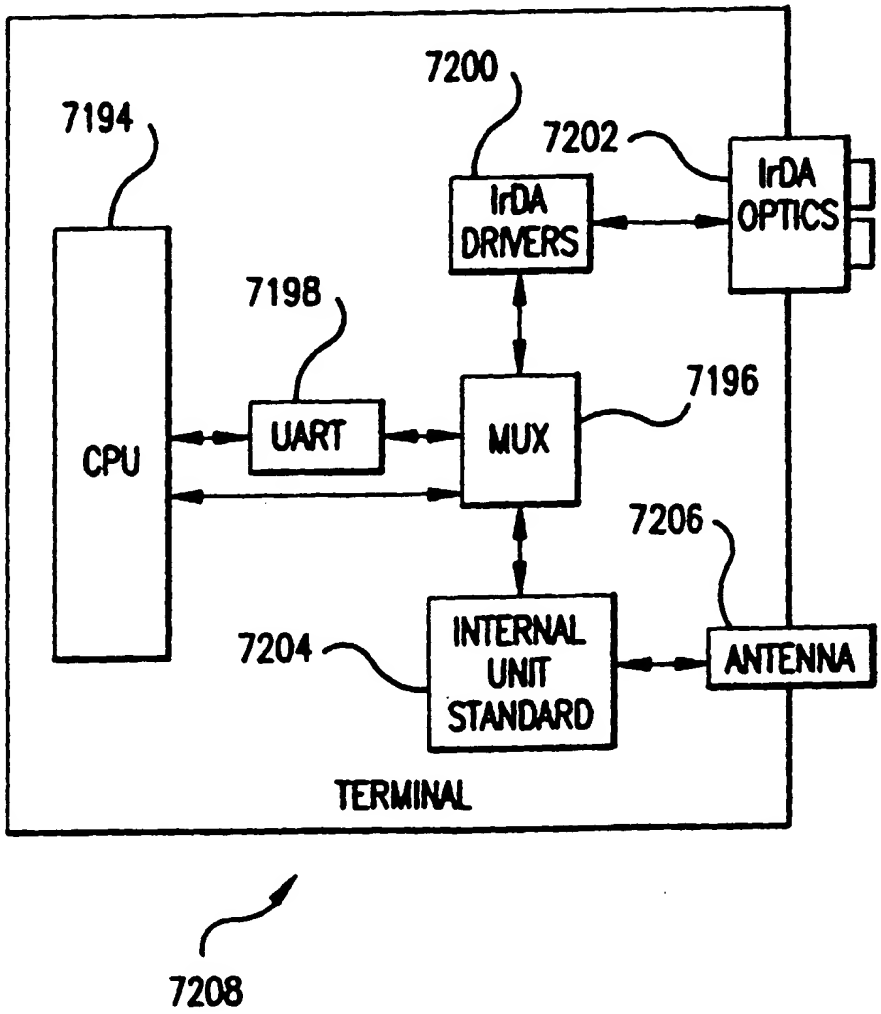
7200
7194
7202
IrDA
DRIVERS
IrDA
OPTICS
7198
7196
CPU
UART
MUX
7206
7204
INTERNAL
UNIT
STANDARD
ANTENNA
TERMINAL
7208

FIG.47

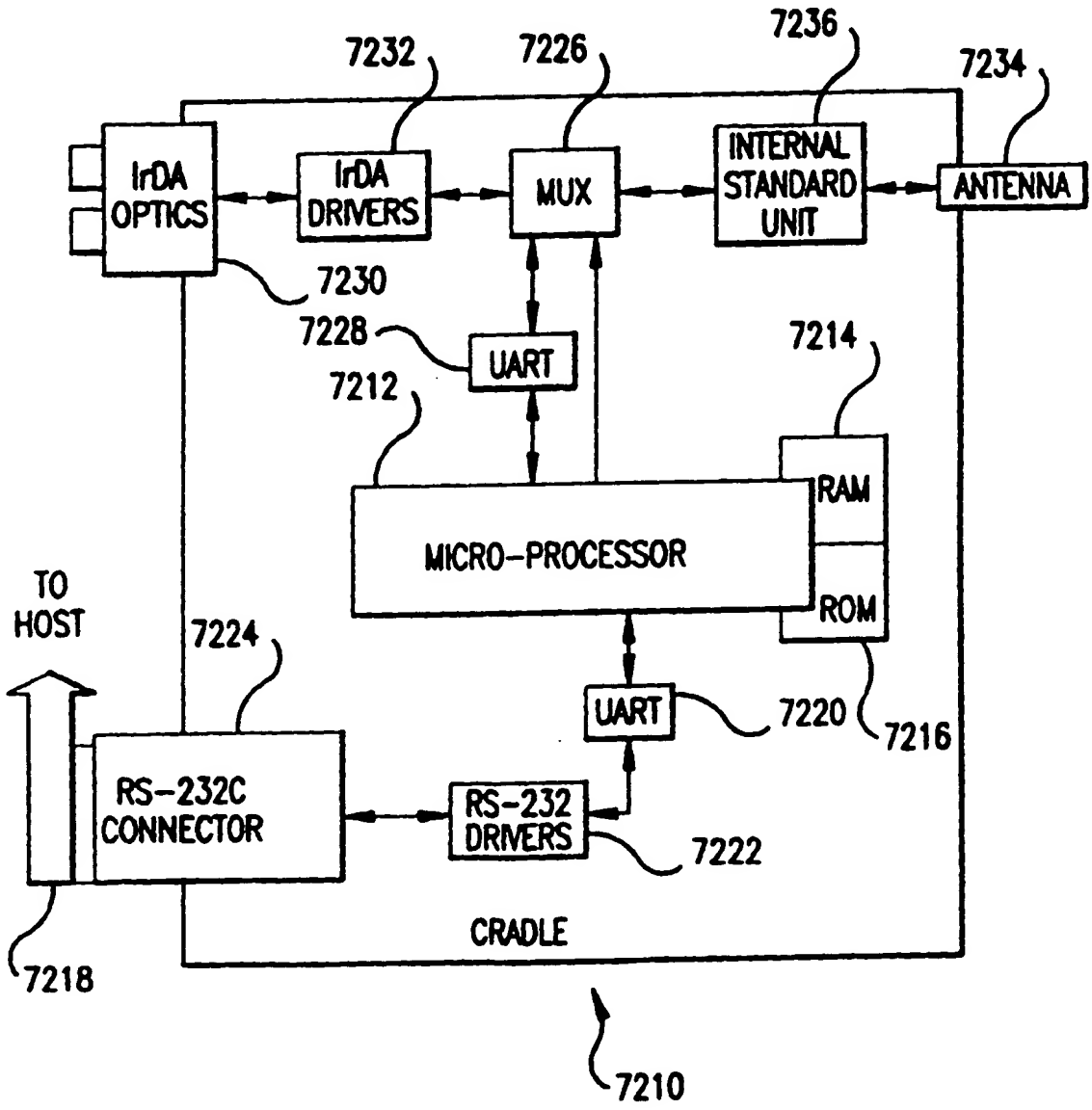
7232
7226
7236
7234
IrDA OPTICS
IrDA DRIVERS
MUX
INTERNAL STANDARD UNIT
ANTENNA
7230
7228
UART
7214
7212
RAM
MICRO-PROCESSOR
ROM
TO HOST
7224
UART
7220
7216
RS-232C CONNECTOR
RS-232 DRIVERS
7222
CRADLE
7218
7210

FIG.48

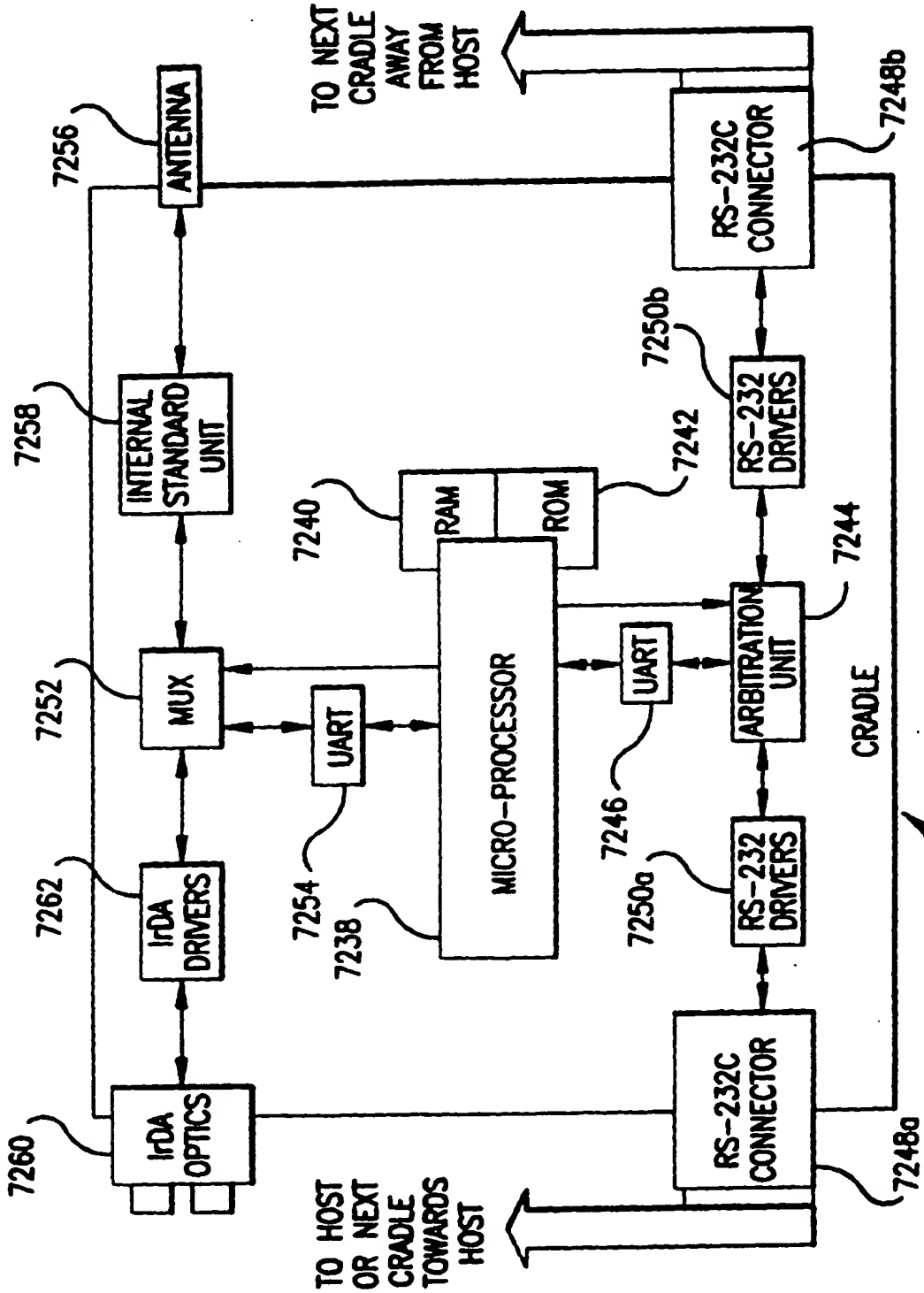
TO NEXT CRADLE AWAY FROM HOST
7256
ANTENNA
7258
INTERNAL STANDARD UNIT
7252
MUX
7262
IrDA DRIVERS
7260
IrDA OPTICS
TO HOST OR NEXT CRADLE TOWARDS HOST
7254
UART
7238
MICRO-PROCESSOR
7240
RAM
ROM
7242
7246
UART
7244
ARBITRATION UNIT
7250a
RS-232 DRIVERS
7250b
RS-232 DRIVERS
RS-232C CONNECTOR
7248a
RS-232C CONNECTOR
7248b
CRADLE
264

FIG.49

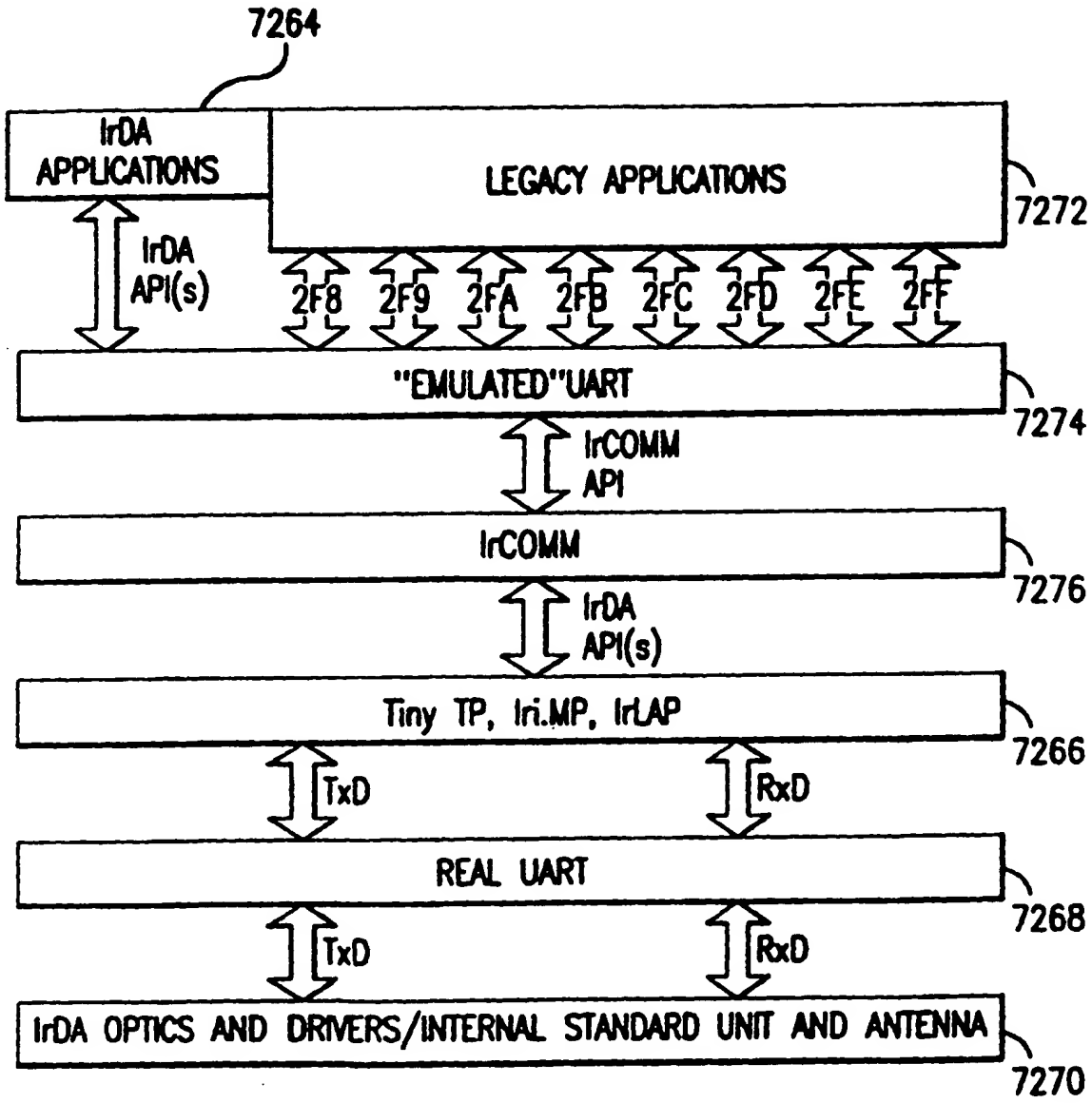
7264
IrDA APPLICATIONS
LEGACY APPLICATIONS
7272
IrDA API(s)
2F8
2F9
2FA
2FB
2FC
2FD
2FE
2FF
"EMULATED" UART
7274
IrCOMM API
IrCOMM
7276
IrDA API(s)
Tiny TP, Iri.MP, IrLAP
7266
TxD
RxD
REAL UART
7268
TxD
RxD
IrDA OPTICS AND DRIVERS/INTERNAL STANDARD UNIT AND ANTENNA
7270

FIG.50

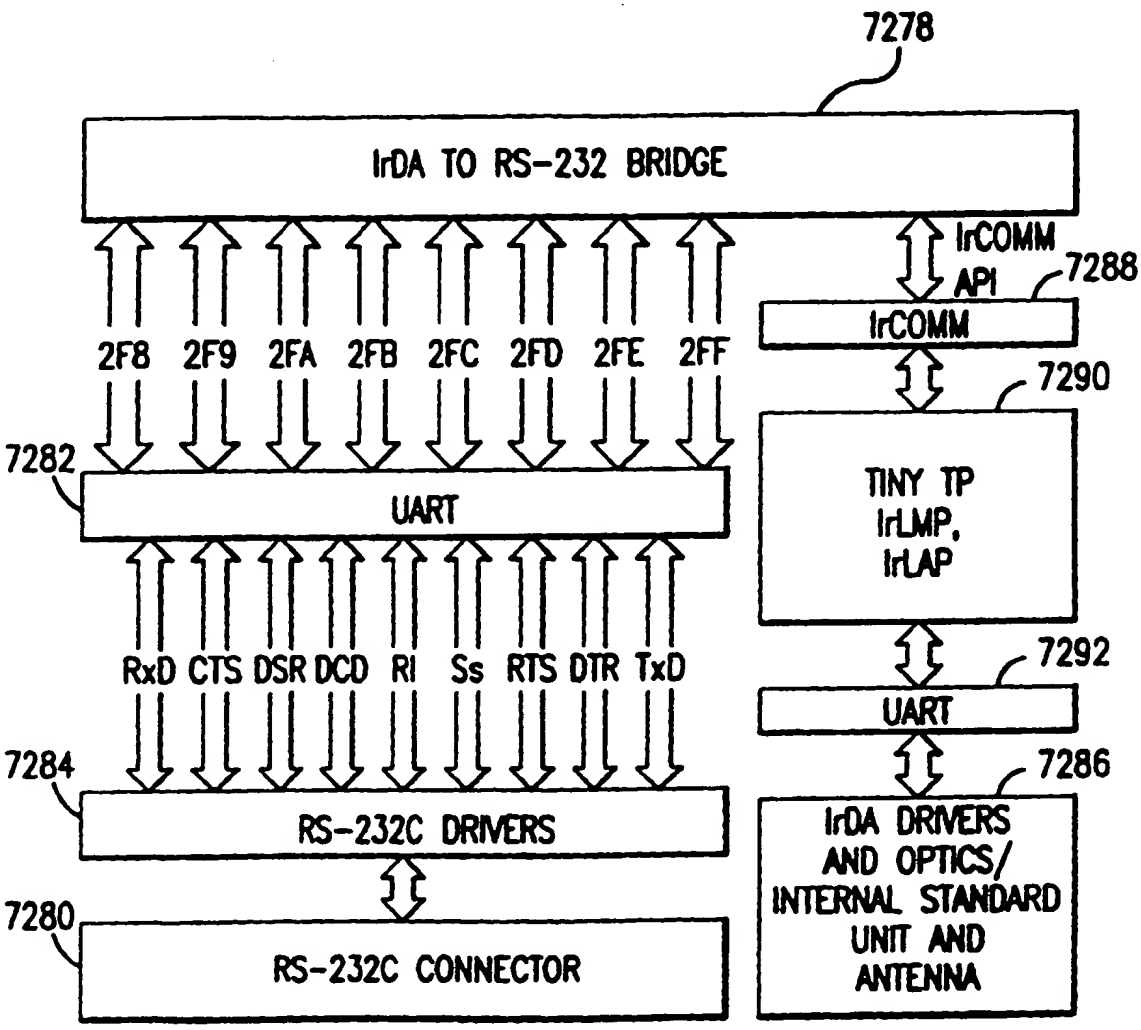
7278
IrDA TO RS-232 BRIDGE
IrCOMM
API
7288
IrCOMM
7290
2F8 2F9 2FA 2FB 2FC 2FD 2FE 2FF
7282
UART
TINY TP
IrLMP,
IrLAP
RxD CTS DSR DCD RI Ss RTS DTR TxD
7292
UART
7284
7286
RS-232C DRIVERS
IrDA DRIVERS
AND OPTICS/
INTERNAL STANDARD
UNIT AND
ANTENNA
7280
RS-232C CONNECTOR

FIG.51

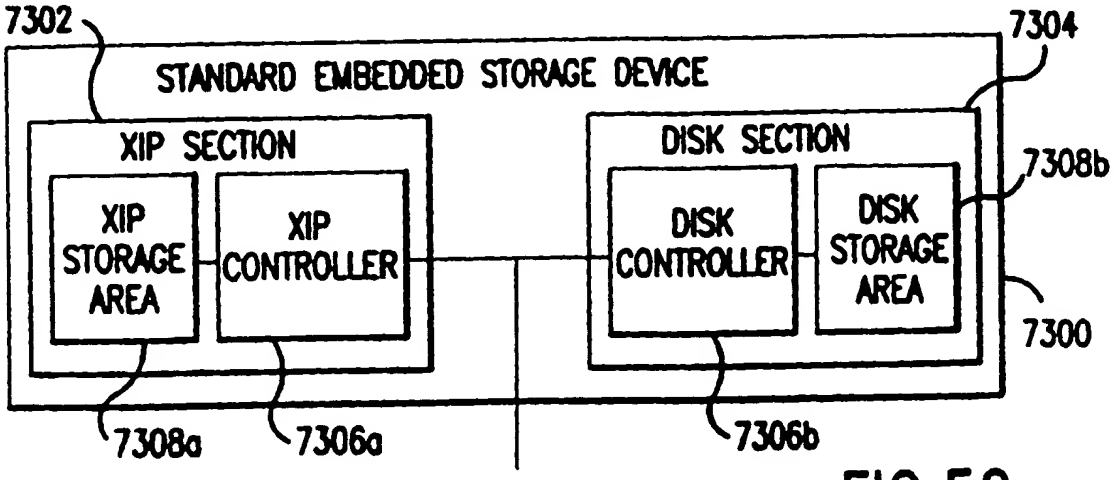

FIG.52

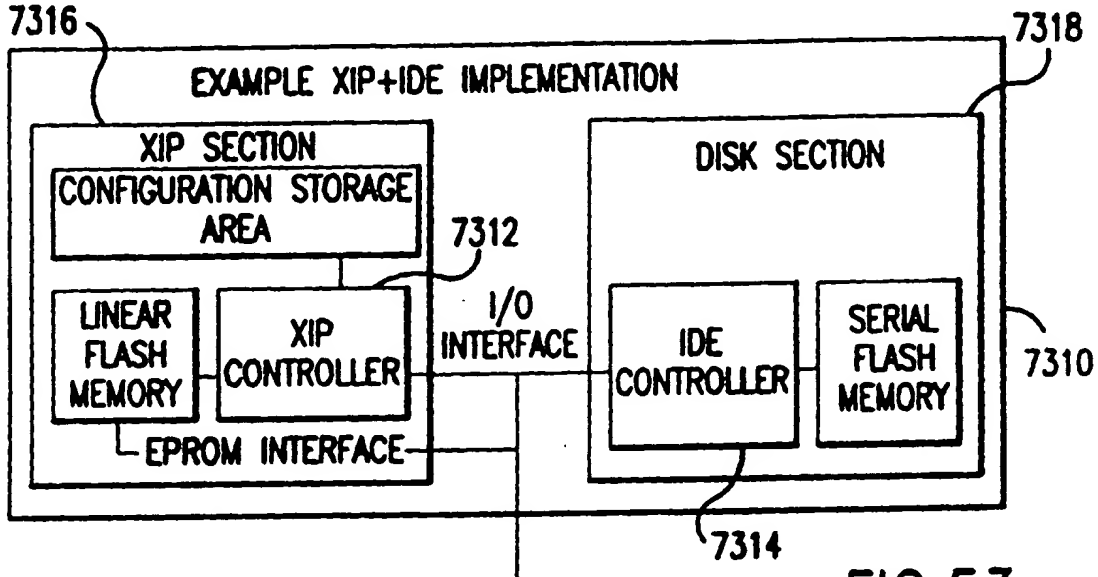

FIG.53

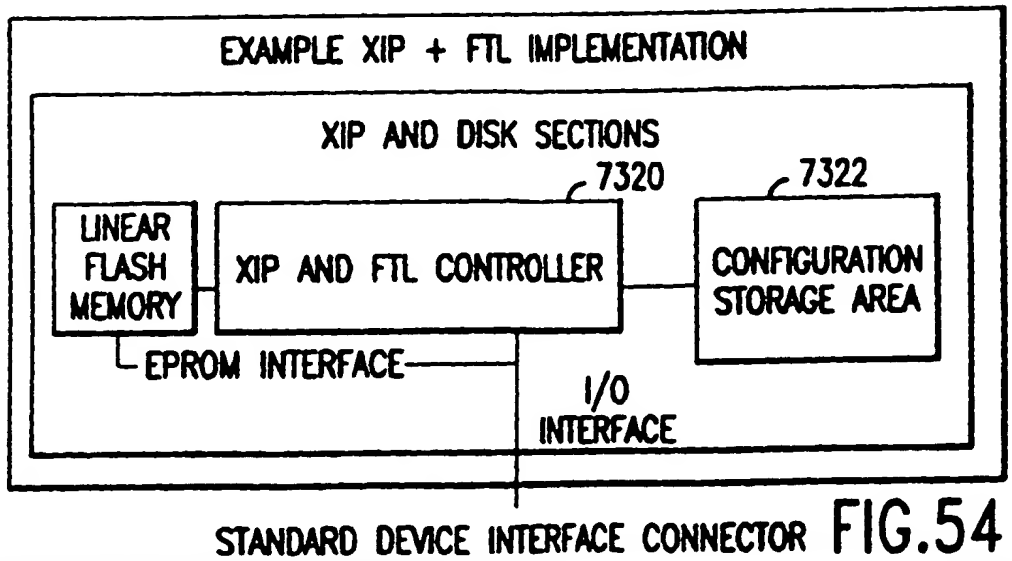

FIG.54

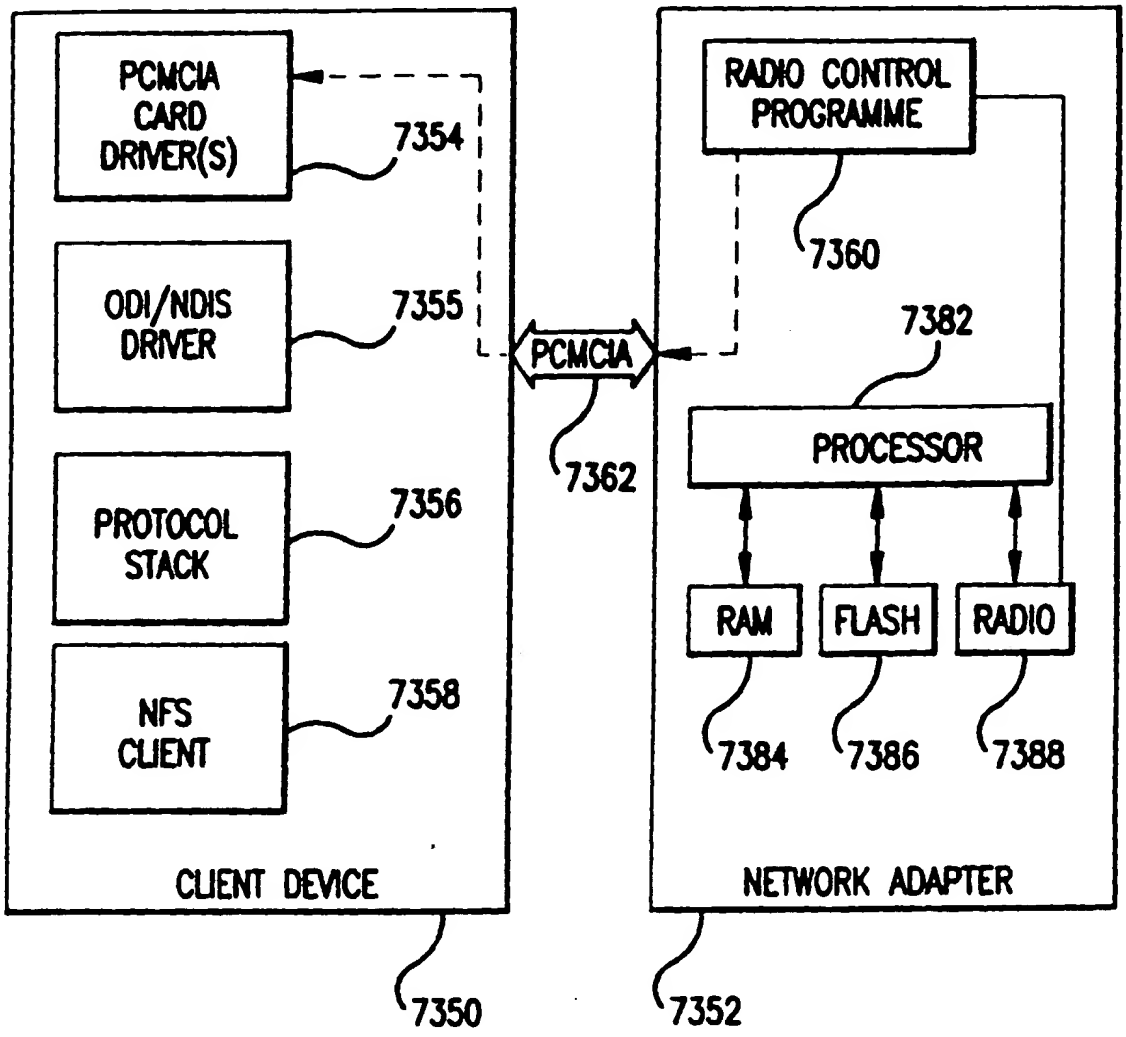
PCMCIA CARD DRIVER(S)
7354
ODI/NDIS DRIVER
7355
PROTOCOL STACK
7356
NFS CLIENT
7358
CLIENT DEVICE
7350
PCMCIA
7362
RADIO CONTROL PROGRAMME
7360
7382
PROCESSOR
RAM
FLASH
RADIO
7384
7386
7388
NETWORK ADAPTER
7352

FIG.55

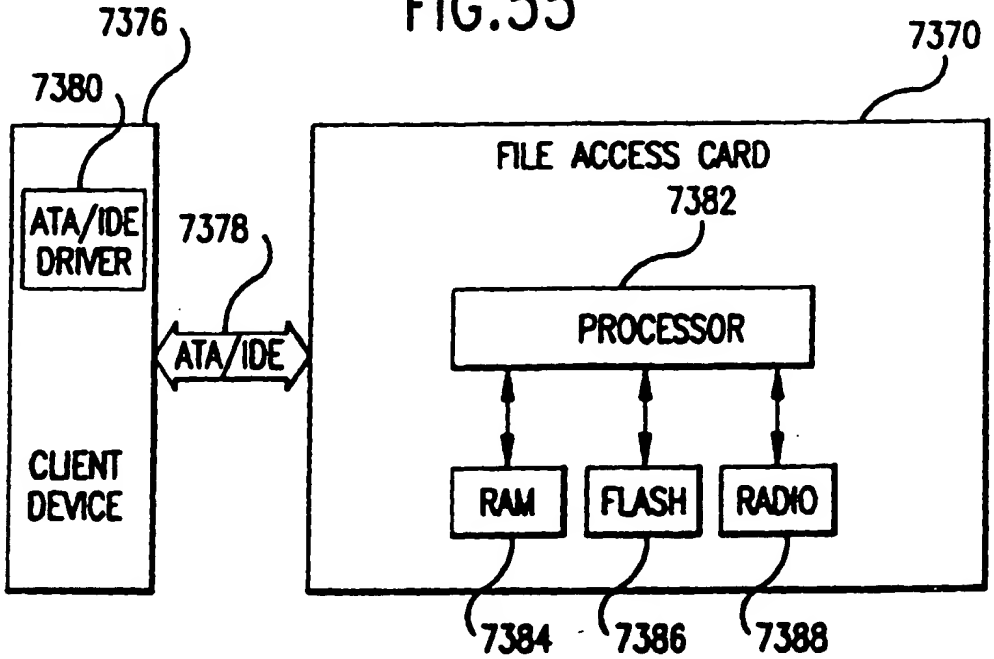
7376
7380
ATA/IDE DRIVER
7378
ATA/IDE
CLIENT DEVICE
7370
FILE ACCESS CARD
7382
PROCESSOR
RAM
FLASH
RADIO
7384
7386
7388

FIG.56

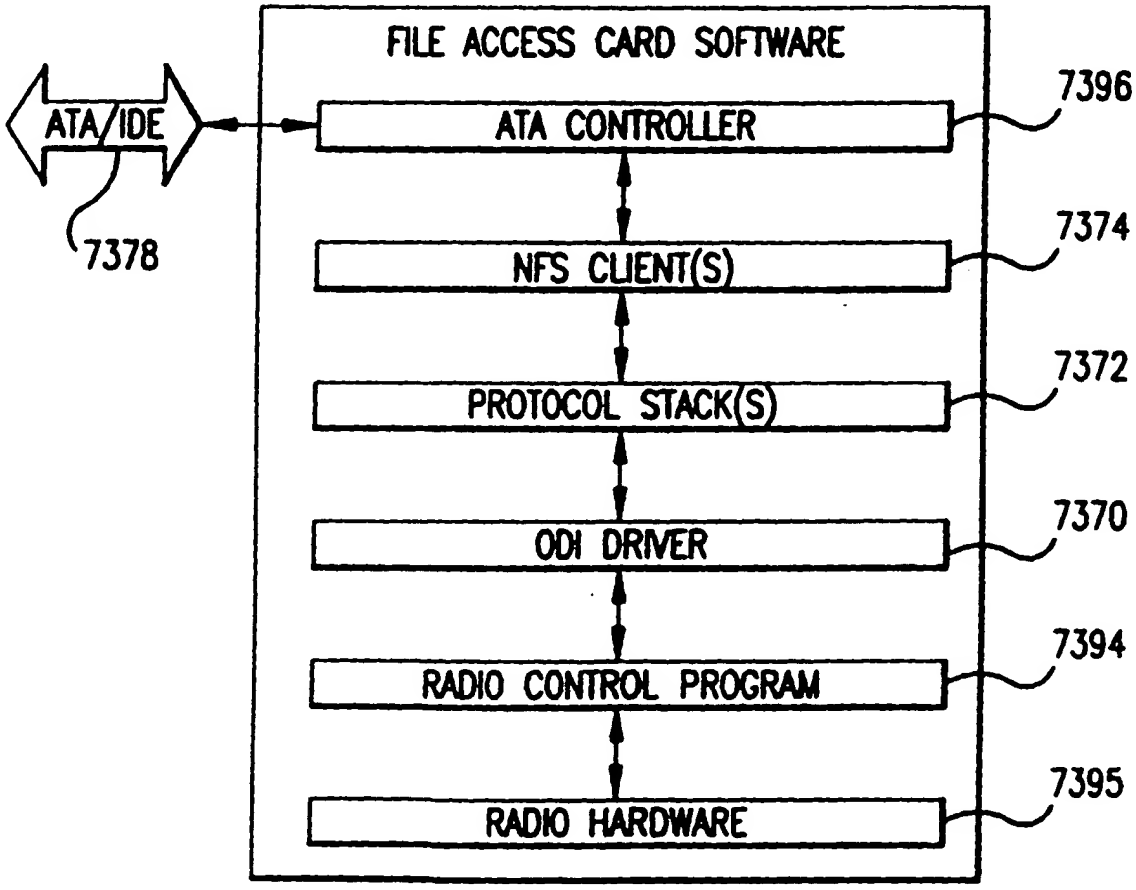
FILE ACCESS CARD SOFTWARE
ATA/IDE
7378
ATA CONTROLLER
7396
NFS CLIENT(S)
7374
PROTOCOL STACK(S)
7372
ODI DRIVER
7370
RADIO CONTROL PROGRAM
7394
RADIO HARDWARE
7395

FIG.57

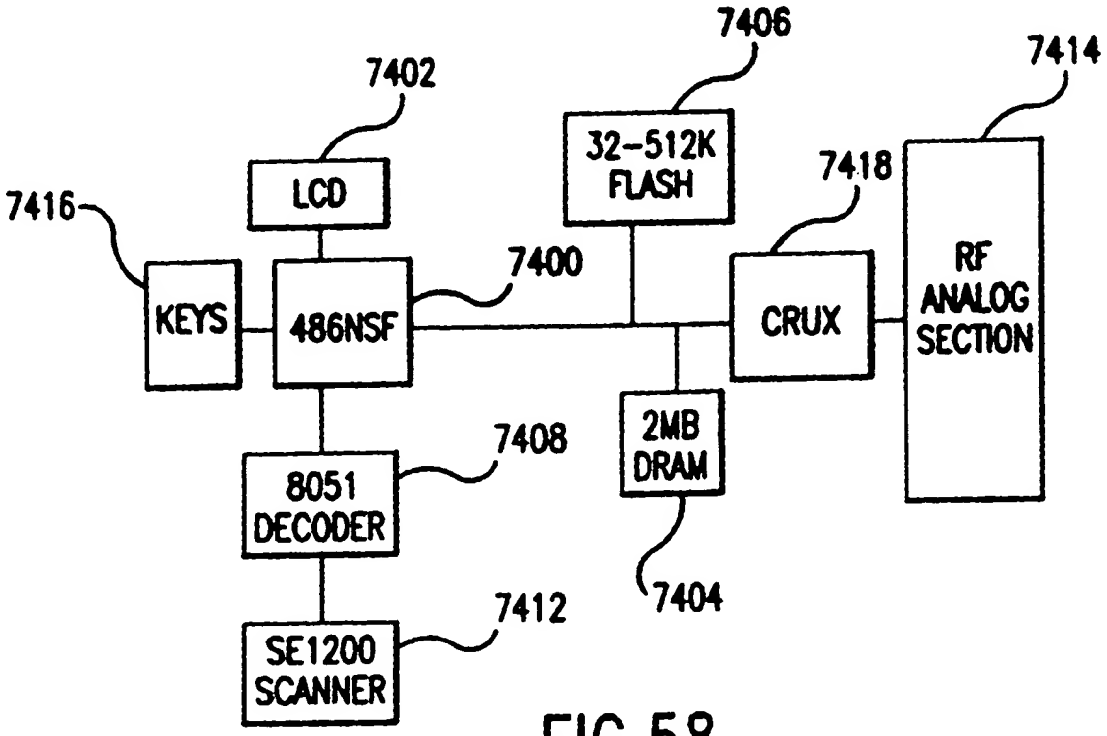
7406
7414
7402
32-512K FLASH
LCD
7418
7416
RF ANALOG SECTION
7400
KEYS
486NSF
CRUX
2MB DRAM
7408
8051 DECODER
7404
7412
SE1200 SCANNER

FIG.58

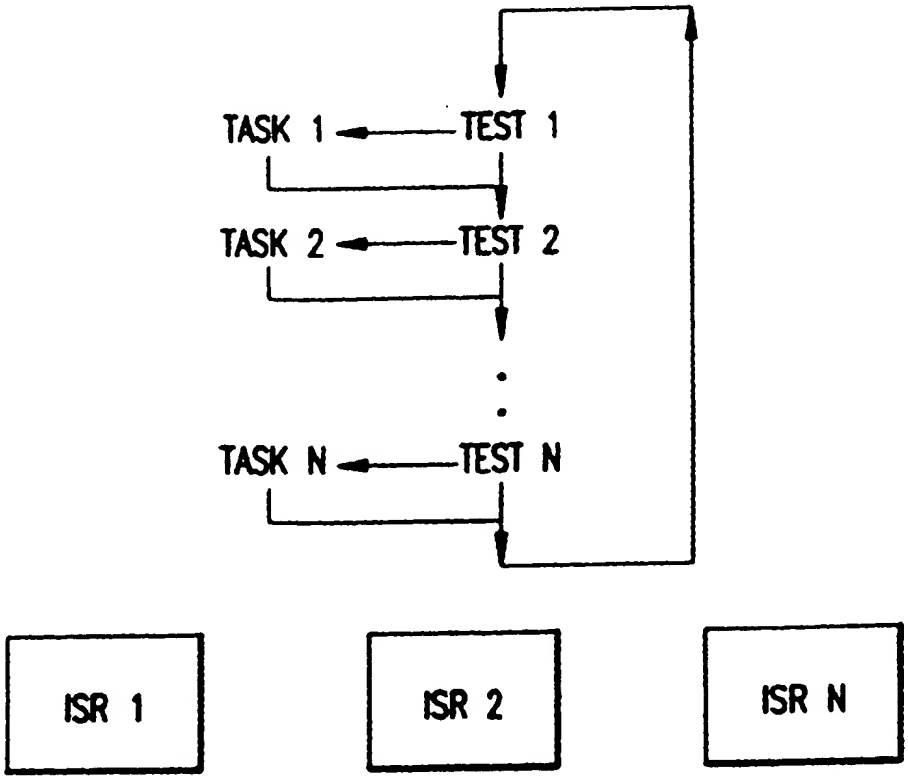
TASK 1
TEST 1
TASK 2
TEST 2
TASK N
TEST N
ISR 1
ISR 2
ISR N

FIG.59

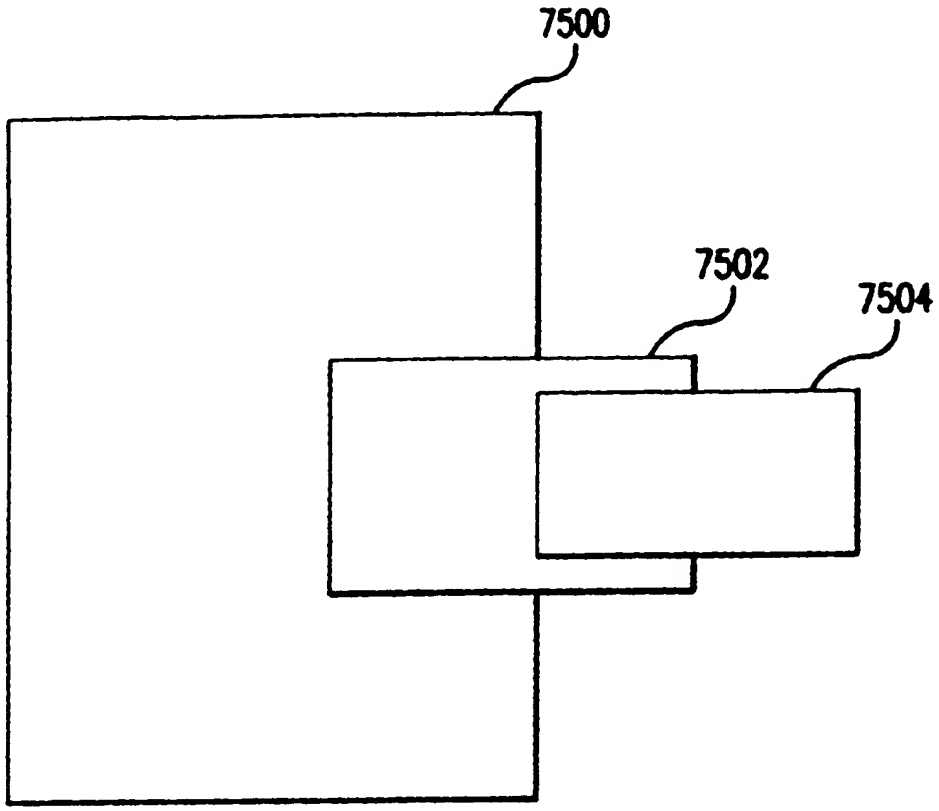

FIG.60a

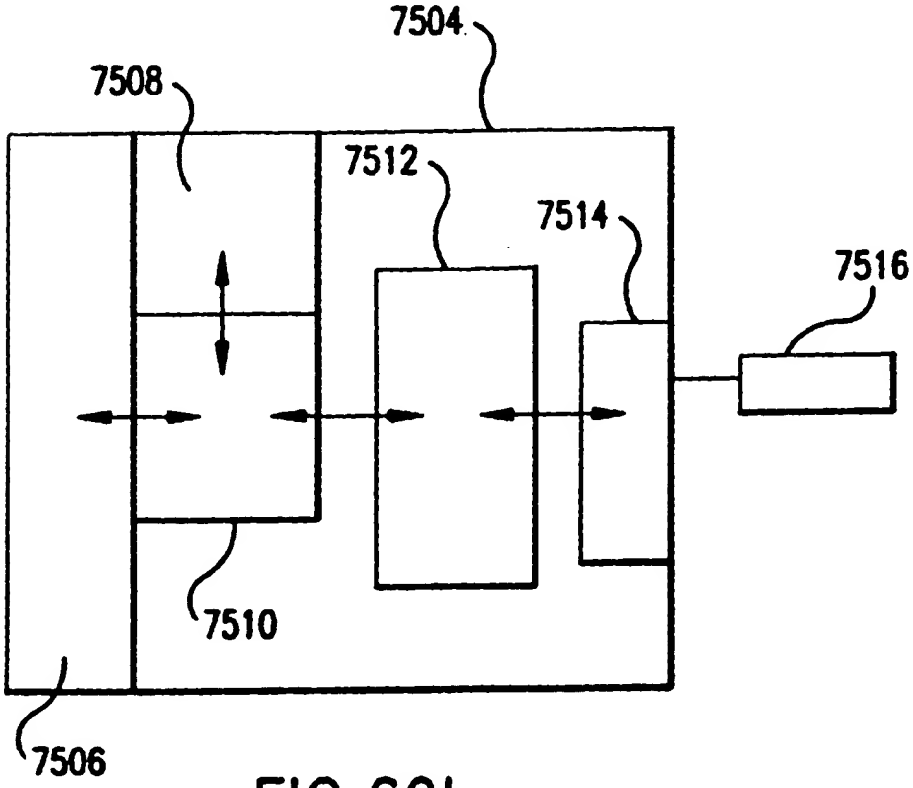

FIG.60b

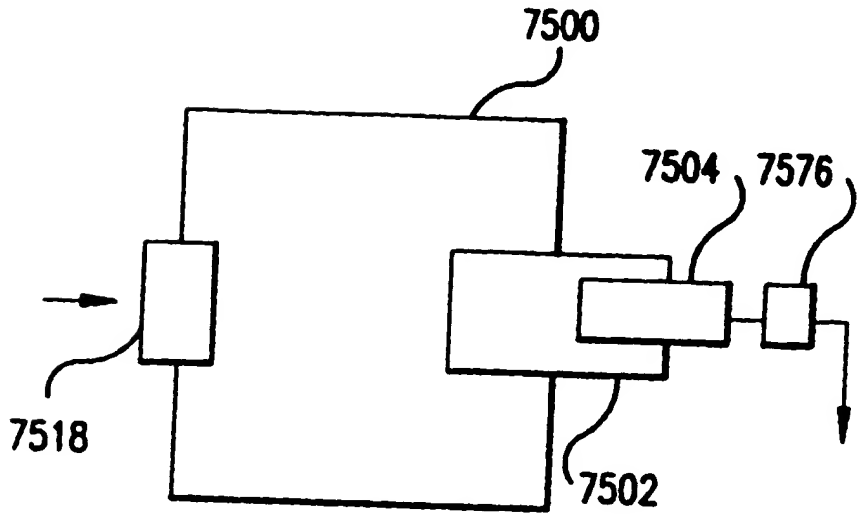

FIG.61a

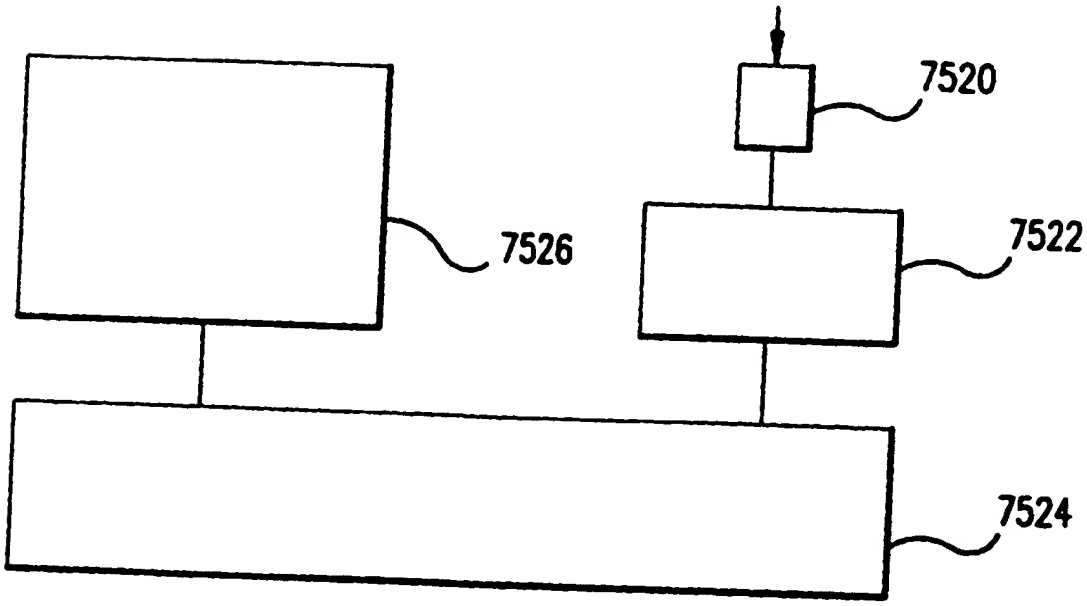

FIG.61b

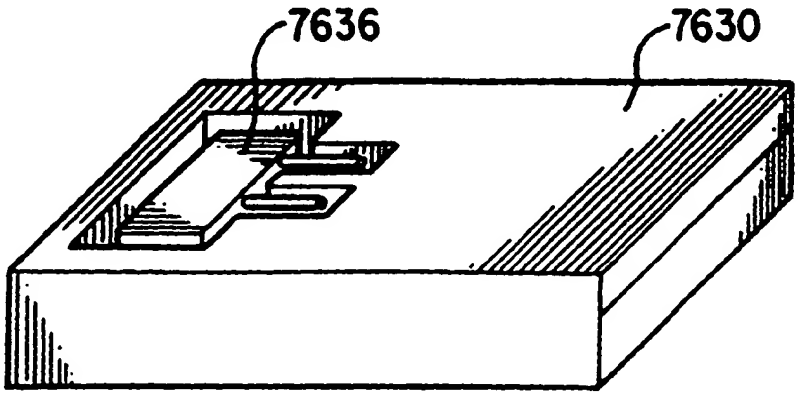

FIG. 63a

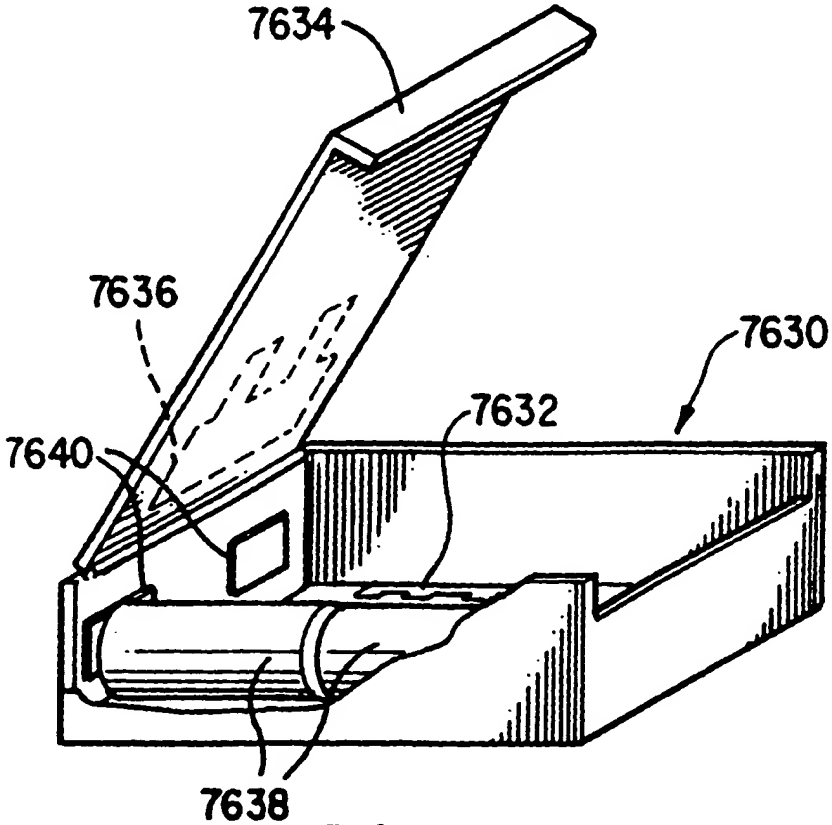

FIG. 63b